

---

# *Implementing a Case-Based, Experiential Learning Pedagogy for Engineering Students at SUTD*

*Peter L. Jackson*

*Head of Pillar*

*Ying Xu*

*Engineering Systems and Design (ESD)*

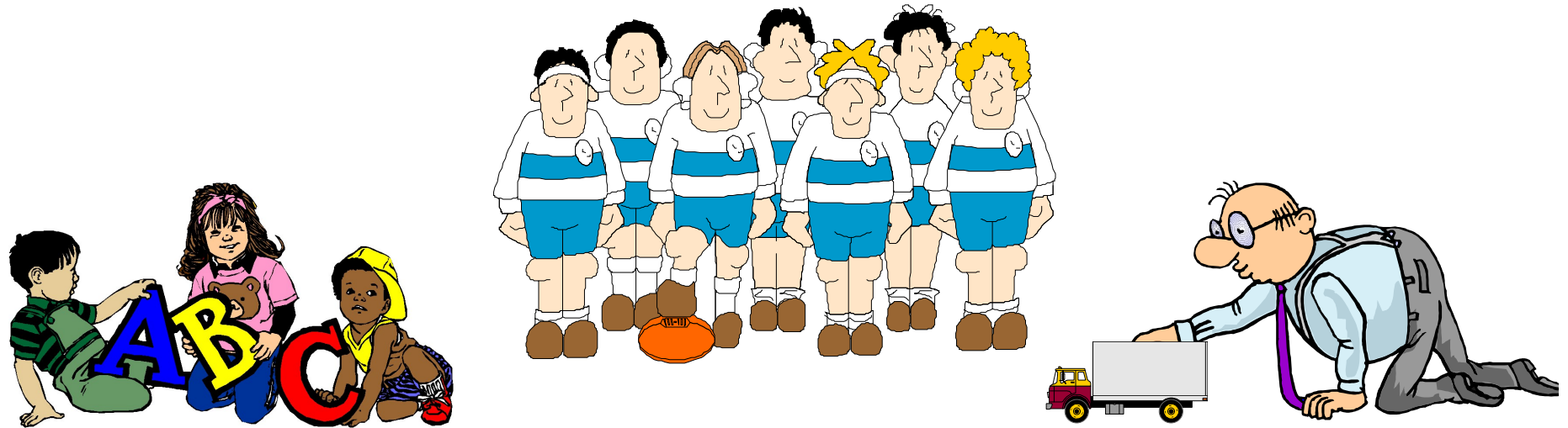
*Singapore University of Technology and Design*

# *Experience as the Best Teacher*



*Human beings learn best from first-hand experience.*

*dolls, blocks, play time, play grounds, dodge ball, soccer  
wind tunnels, wave tanks, role plays, simulations.*



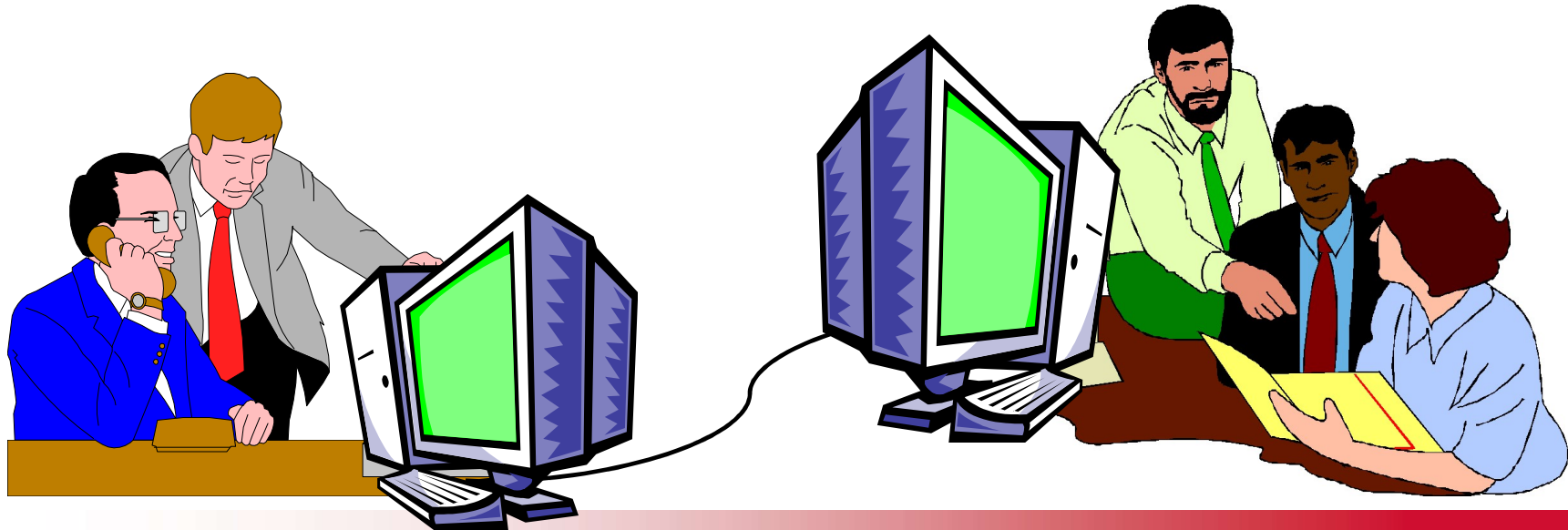
# *The Dilemma*

*Learn by doing only works well only when feedback is fast and unambiguous; yet in organizations one rarely sees the consequences of their most important decisions.*



# Microworlds

*can support "relevant play" in a complex organization by compressing time and space, so that it is possible to experiment and learn by doing even when the consequences of decisions occur in the future and in distant parts of the organization.*



---

*“Tell me and I forget.  
Show me and I remember.  
Involve me and I understand!”*

An old proverb on teaching

---

# *The Nova Supply Chain Game*



# *The Nova Cases*

---

- *Developed by colleagues at Cornell, Univ. of Michigan, and College of William and Mary*
- *Series of cases with rich backstory*
- *Supplemented by multi-player game to cooperatively operate a multi-item, multi-location supply chain*
  - *Scaled to be manageable*
  - *Employs standard operational procedures*
  - *What could possibly go wrong?*



# *Purpose*

---

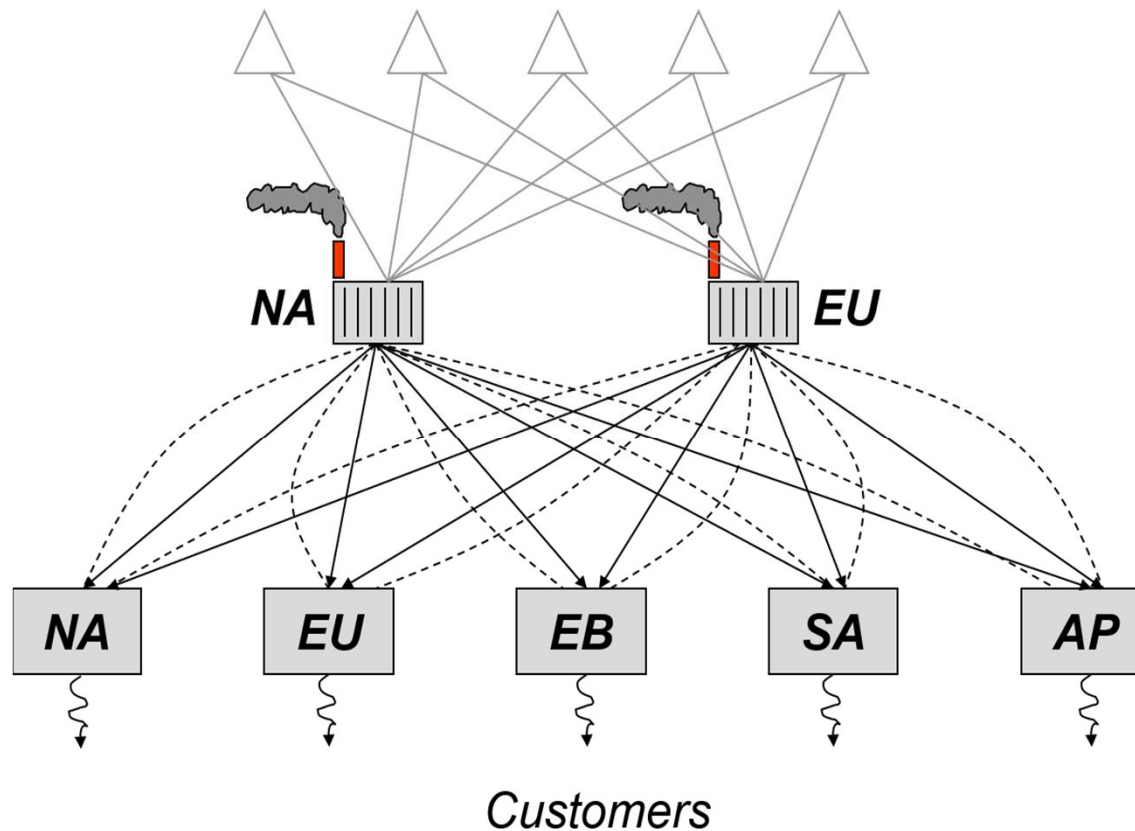
- *To establish the importance of designing and operating a coordinated command and control system for managing resources in a dynamic, uncertain and constrained supply chain.*



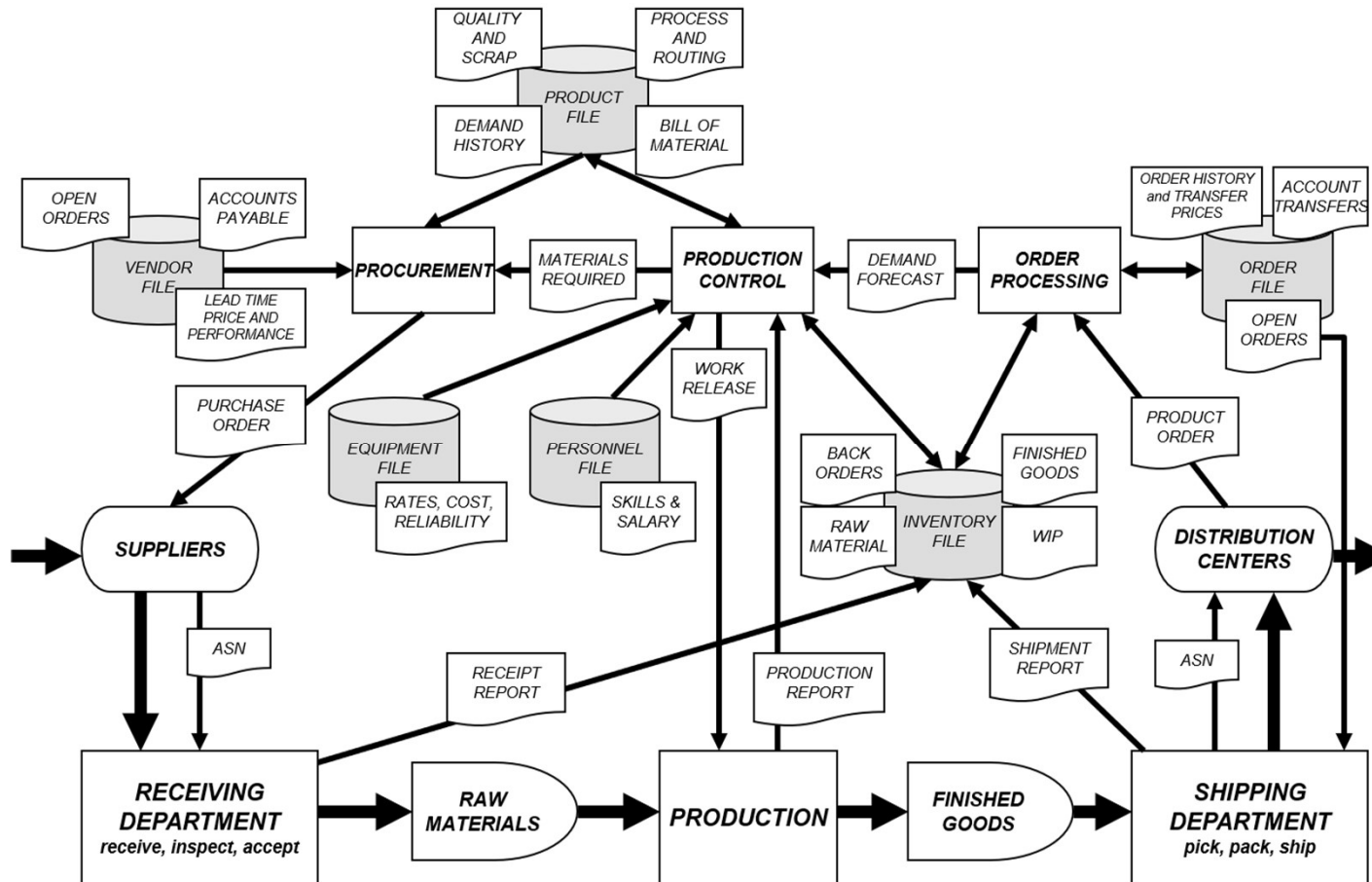
# *NOVA Gameplay in Data Analytics Lab*



# NOVA Corporation Global Supply Chain



# Material Flows and Information Exchanges in NOVA



# Daily Activities at a Factory in NOVA



The Nova Corporation - [Team 01 - European Factory]

File View Window

**Daily Activities**

**Day 1**

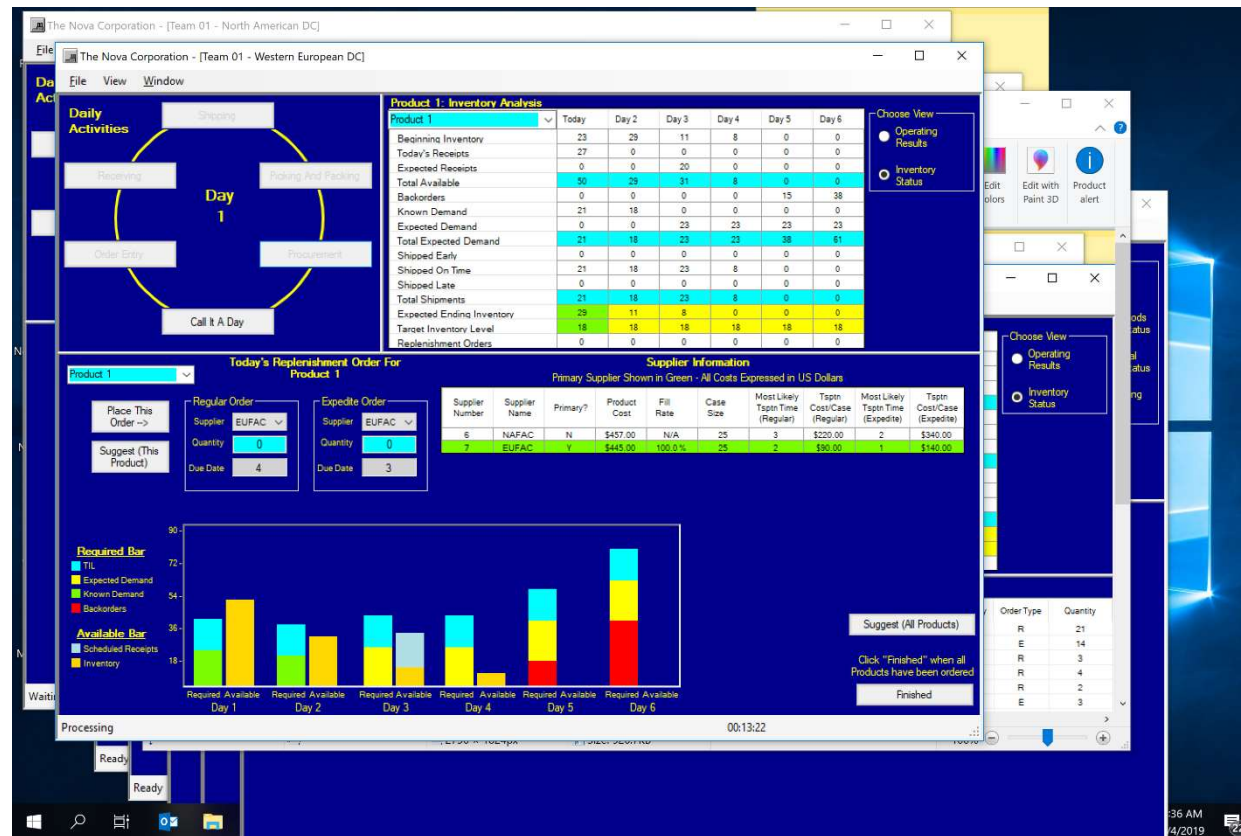
**Product 1: Inventory Analysis**

Product 1	Today	Day 2	Day 3	Day 4	Day 5	Day 6
Beginning Inventory	44	22	0	0	0	0
Prior Day's Production (Plan)	22	0	0	0	0	0
Current Day's Production (Plan)	0	0	0	0	0	0
Total Available	66	22	0	0	0	0
Backorders	0	0	22	66	110	154
Known Demand	0	0	0	0	0	0
Expected Demand	44	44	44	44	44	44
Total Expected Demand	44	44	66	110	154	198
Shipped Early	0	0	0	0	0	0
Shipped On Time	44	22	0	0	0	0
Shipped Late	0	0	0	0	0	0
Total Shipments	44	22	0	0	0	0
Expected Ending Inventory	22	0	0	0	0	0
Target Inventory Level	25	25	25	25	25	25
Replenishment Orders	0	0	0	0	0	0

Choose View

- Operating Results
- Finished Goods Inventory Status
- Raw Material Inventory Status
- Manufacturing Specs

# Decision Support Interface for Procurement Activity



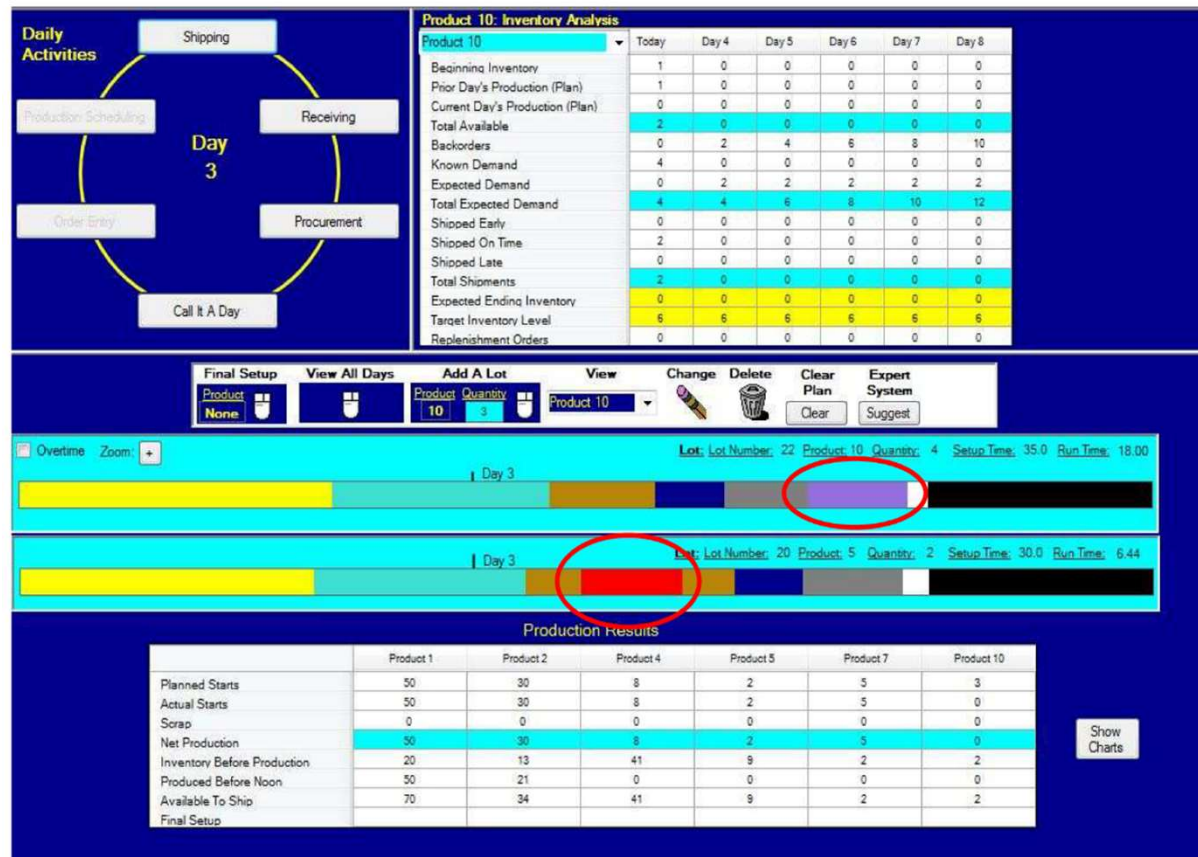


# *But Things Do Go Wrong*

---

- *Your team-mates over-order*
- *Machine breakdowns create supply uncertainty*
- *Erratic customers create demand uncertainty*
- *Time lags in information transfer mean you are making decisions on old information*
- *In short, life happens.*

# Impact of Machine Breakdowns on Production Schedule



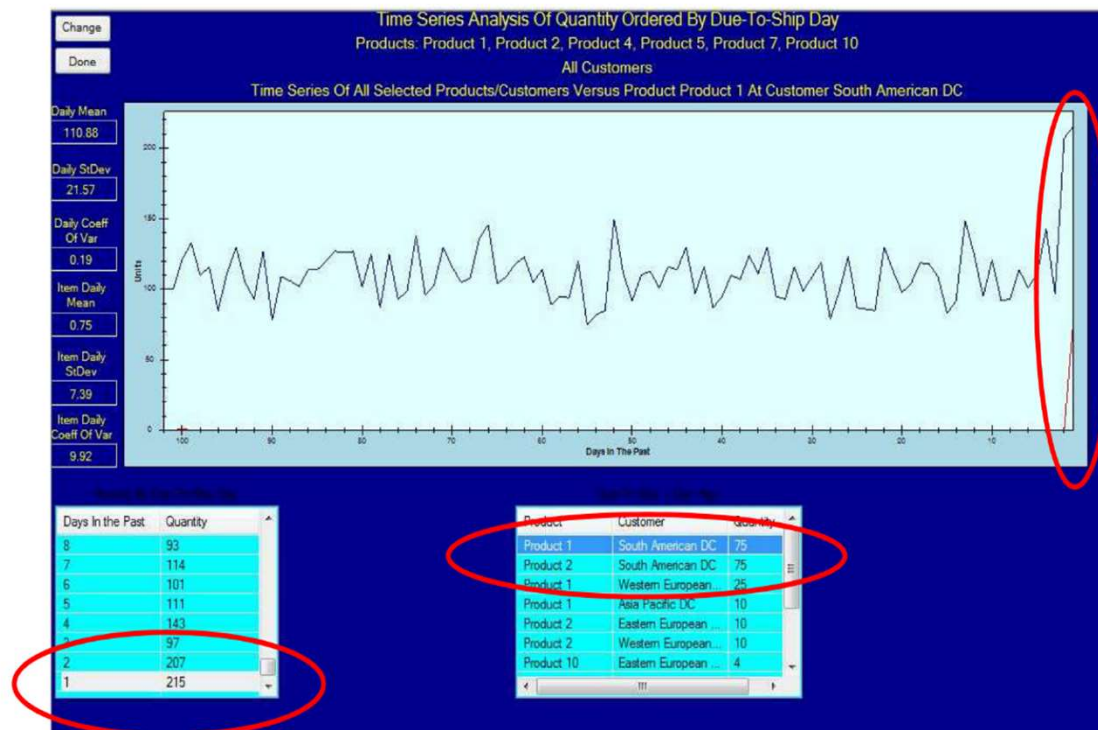
Machine Breakdown affected production for product

Scheduled

Actual  
(red=breakdown)



# Distribution Center Sub-team Surprises Factory Sub-Team with Large Order



Crazy Demand  
on Day4

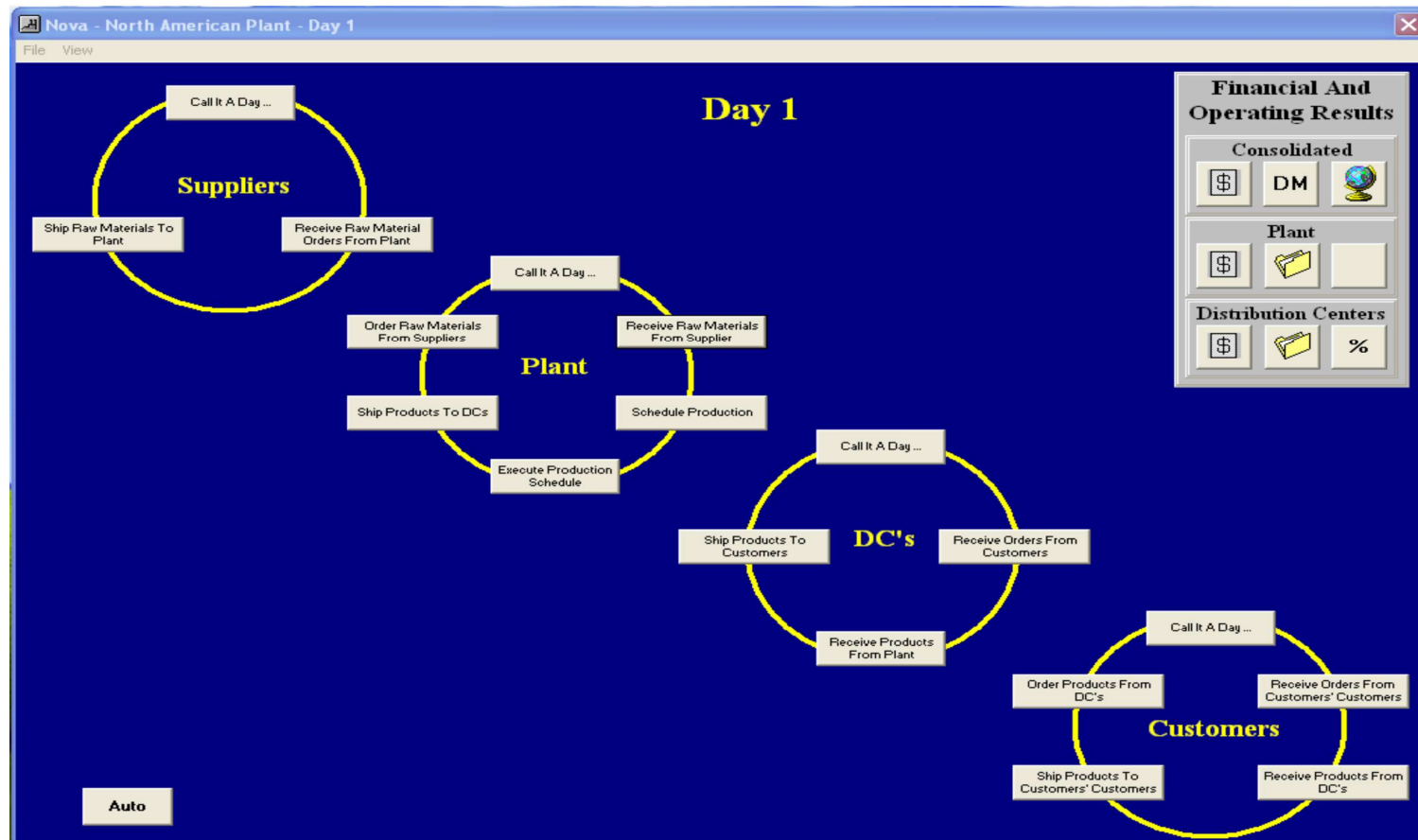


# *What's the Answer?*

---

- *Having experienced the problems, students are primed to find a solution*
- *Lectures and assignments then guide them to understand the importance of initiatives to reduce uncertainty and to exploit risk pooling*
- *Then a simulator is used to show how an integrated system would work*

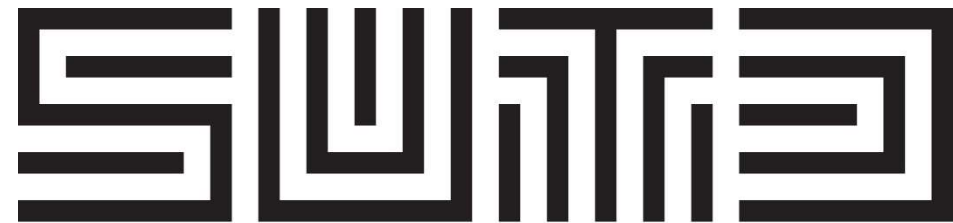
# NOVASim Integrated Supply Chain Decision Support



# *SUTD Experience*

---

- *Students praised the course*
  - *Simulation was a valuable way to learn*
  - *Easy to relate game experiences with real world*
- *But would like more analysis*
  - *We had simplified the course for this first iteration – but, easy to increase the analytical content for next iteration*
- *Microworlds and associated software can be powerful teaching tools*



SINGAPORE UNIVERSITY OF  
TECHNOLOGY AND DESIGN