

# Resources Planning & Capacity Allocation Team

## 資源規劃與產能分派團隊

---

Team Coordinator : Dr. Shih-Min Wang

Team Advisor : Dr. Kung-Jeng Wang

# Members

## Advisor



Prof. Kung-Jeng Wang

## Coordinator



Dr. Dobei Wang

## Research Assistant



Albert Chen

## Seniors



Steve Jang

## Junior



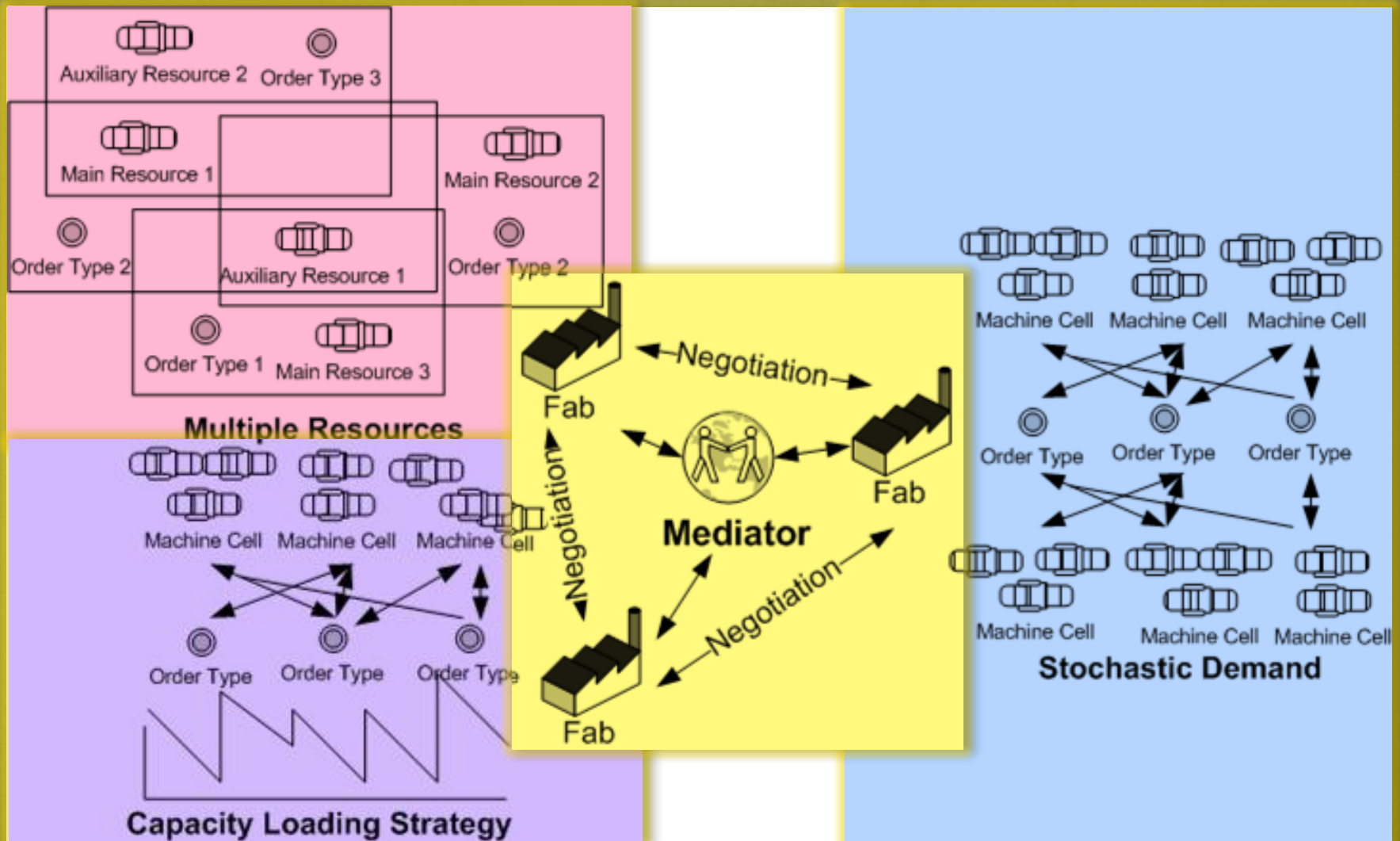
Ted Hsu



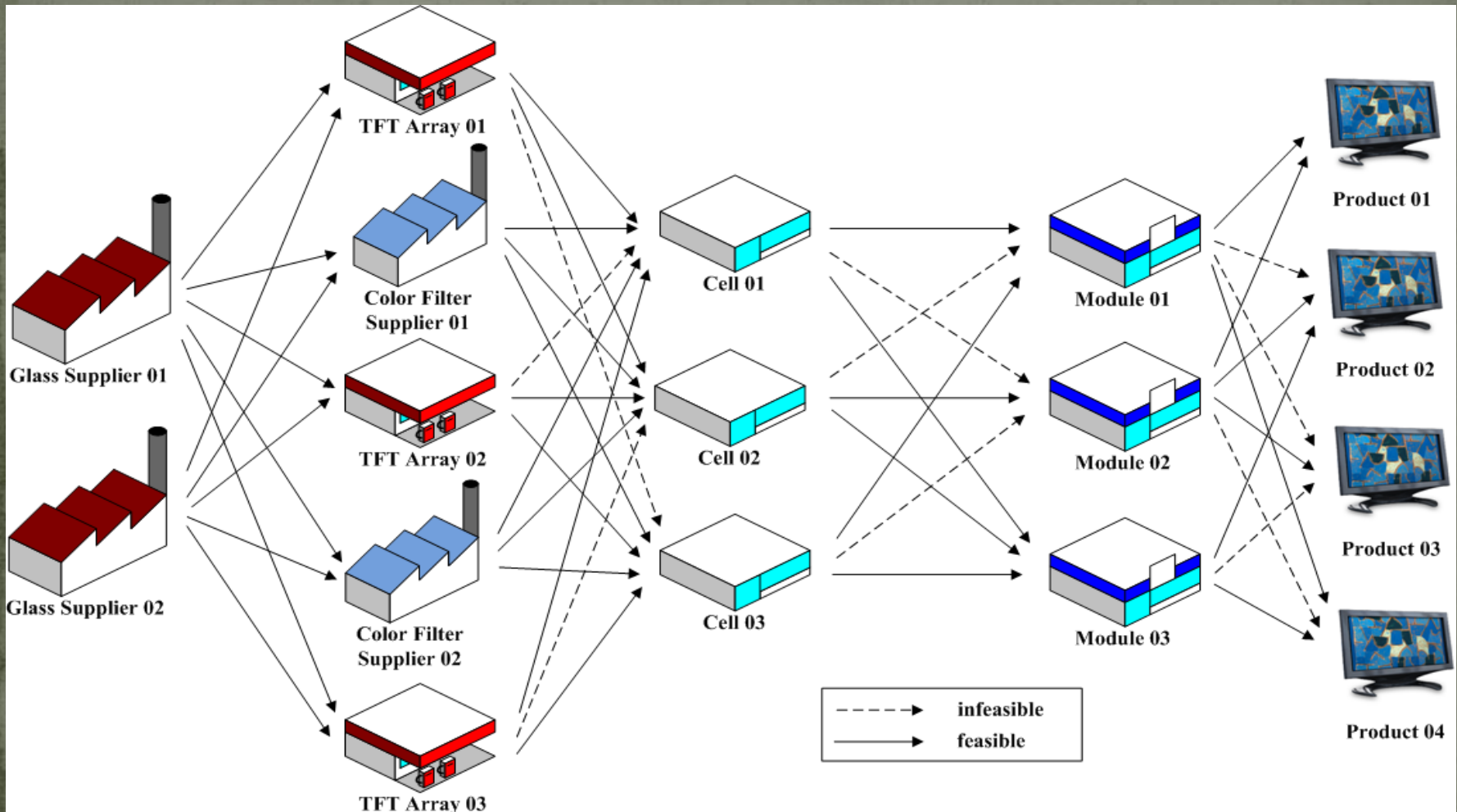
# Research Issues

- **Inter-Factories Issues :**
  - Mediate remaining orders and remaining resources among factories.
  - Allocate limited capital provided by the headquarters.
  - Reduce conflict among departments.
- **Individual Factory Issues :**
  - Formulate characteristics of high-tech industries
  - Develop optimal resources portfolio plan, capacity allocation plan, order selection plan, and inventory plan in high-tech industries
  - Consider production capability and configuration feasibility

# Research Framework -Semiconductor Testing Industry



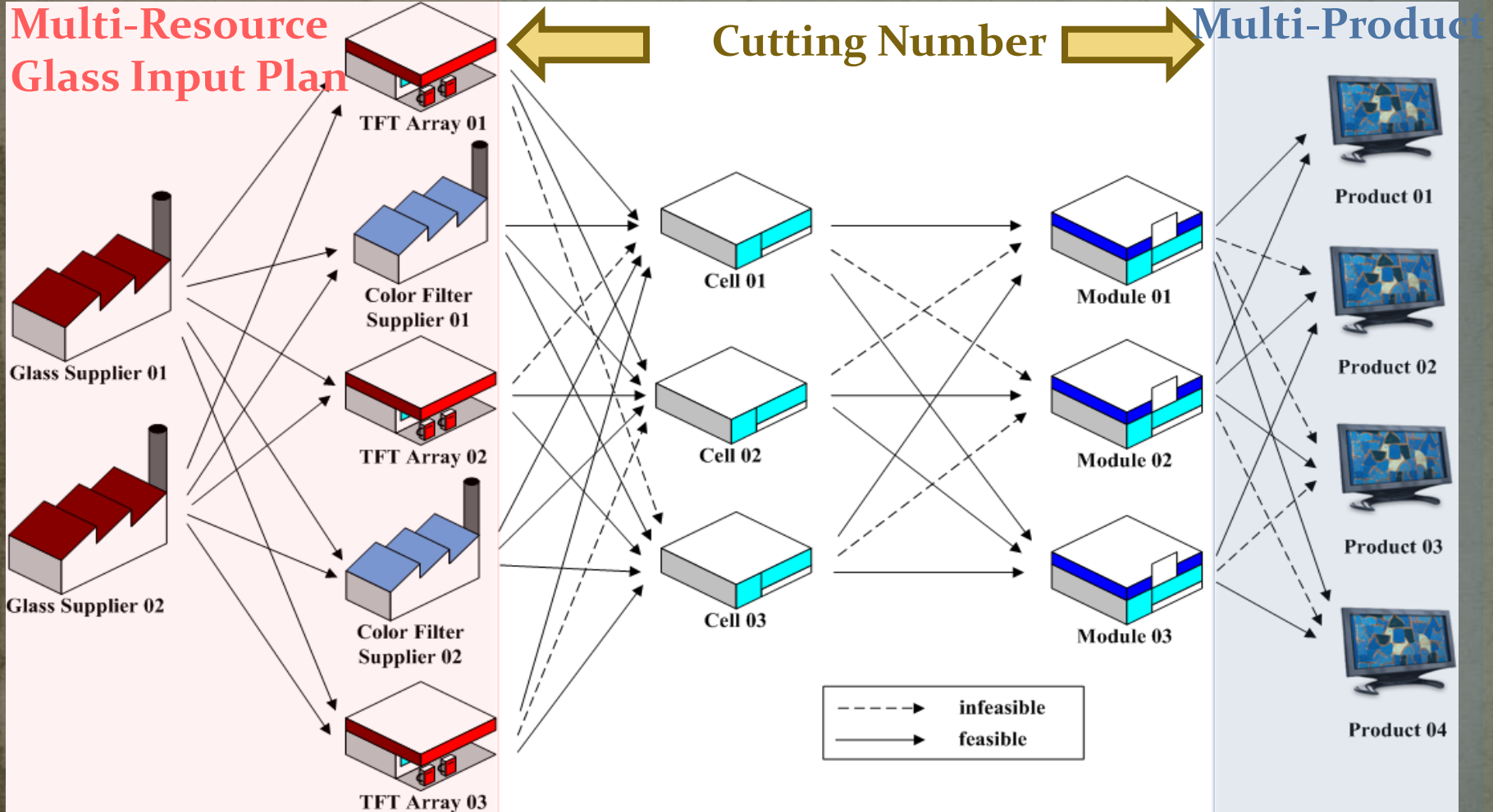
# Capacity Planning for TFT-LCD Supply Chain



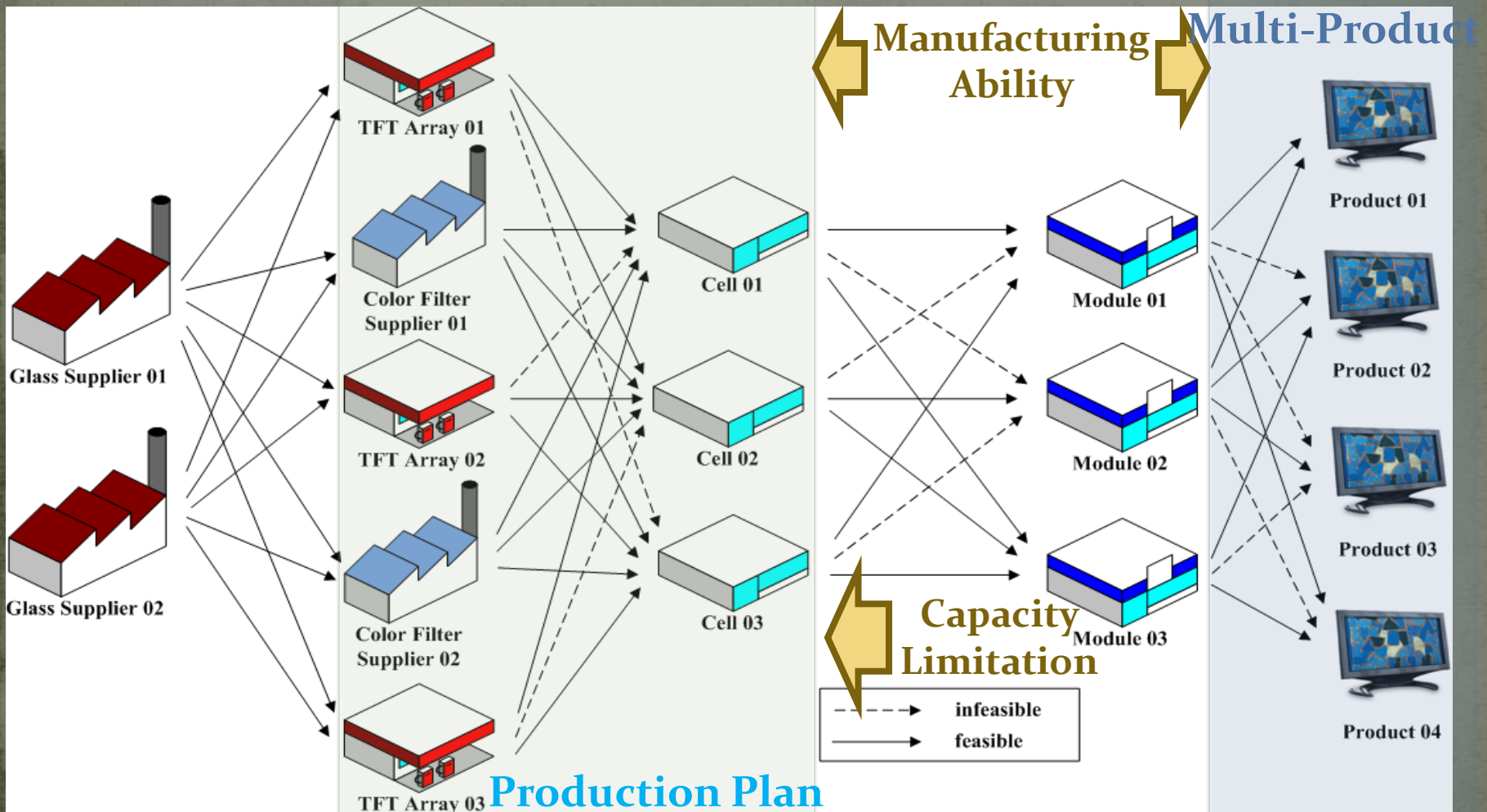


# Capacity Planning for TFT-LCD Supply Chain

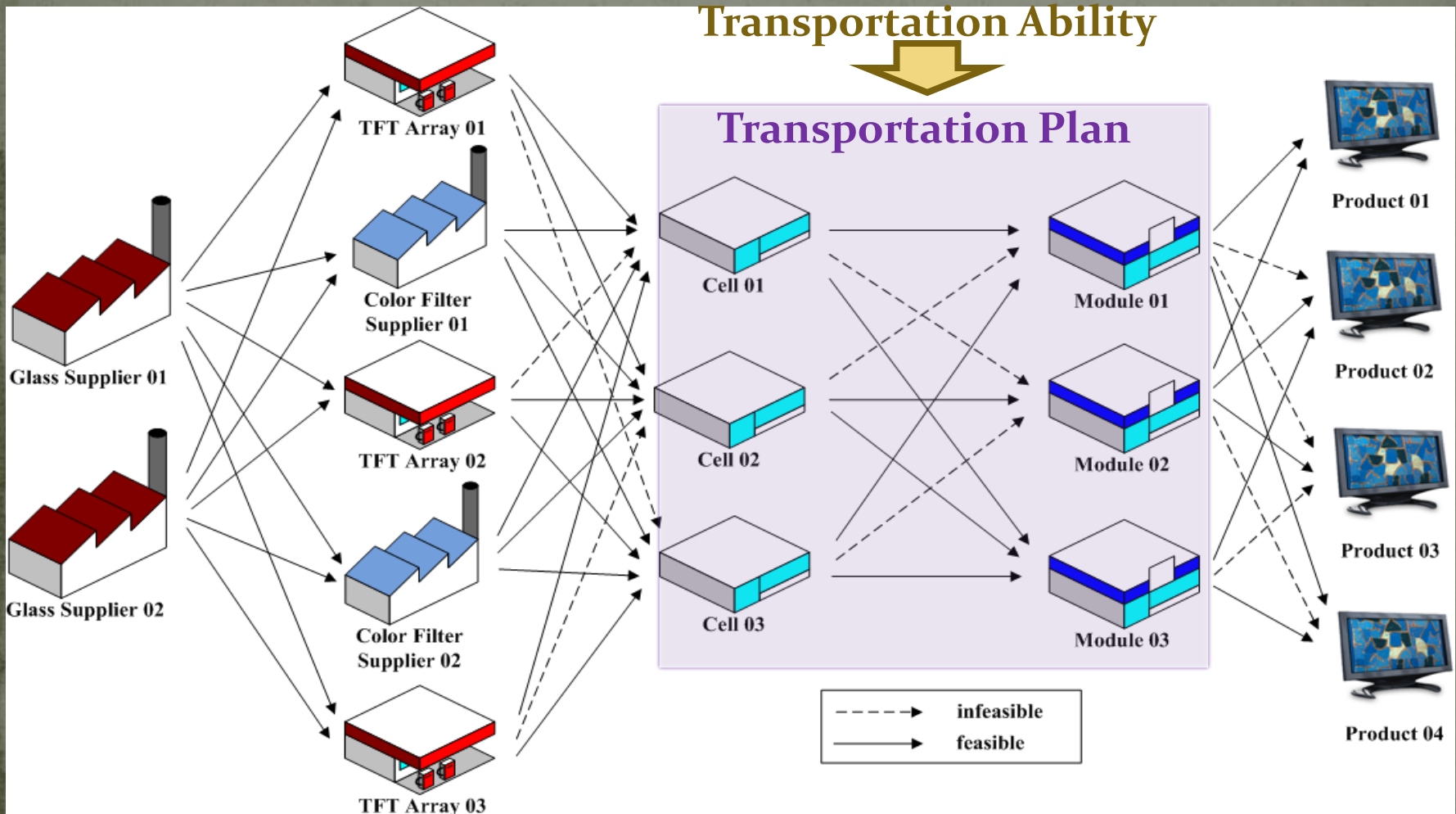
Multi-Resource  
Glass Input Plan



# Capacity Planning for TFT-LCD Supply Chain

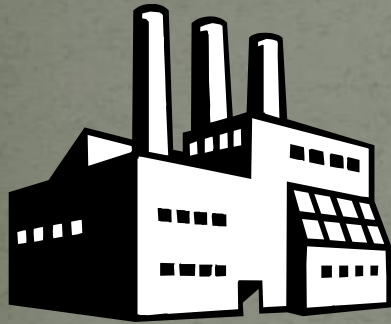


# Capacity Planning for TFT-LCD Supply Chain

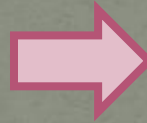




# Negotiation Application in TFT-LCD Industry

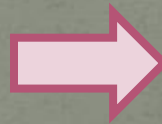


Planning Sector



Maximize Economic Production Value

Production Sector

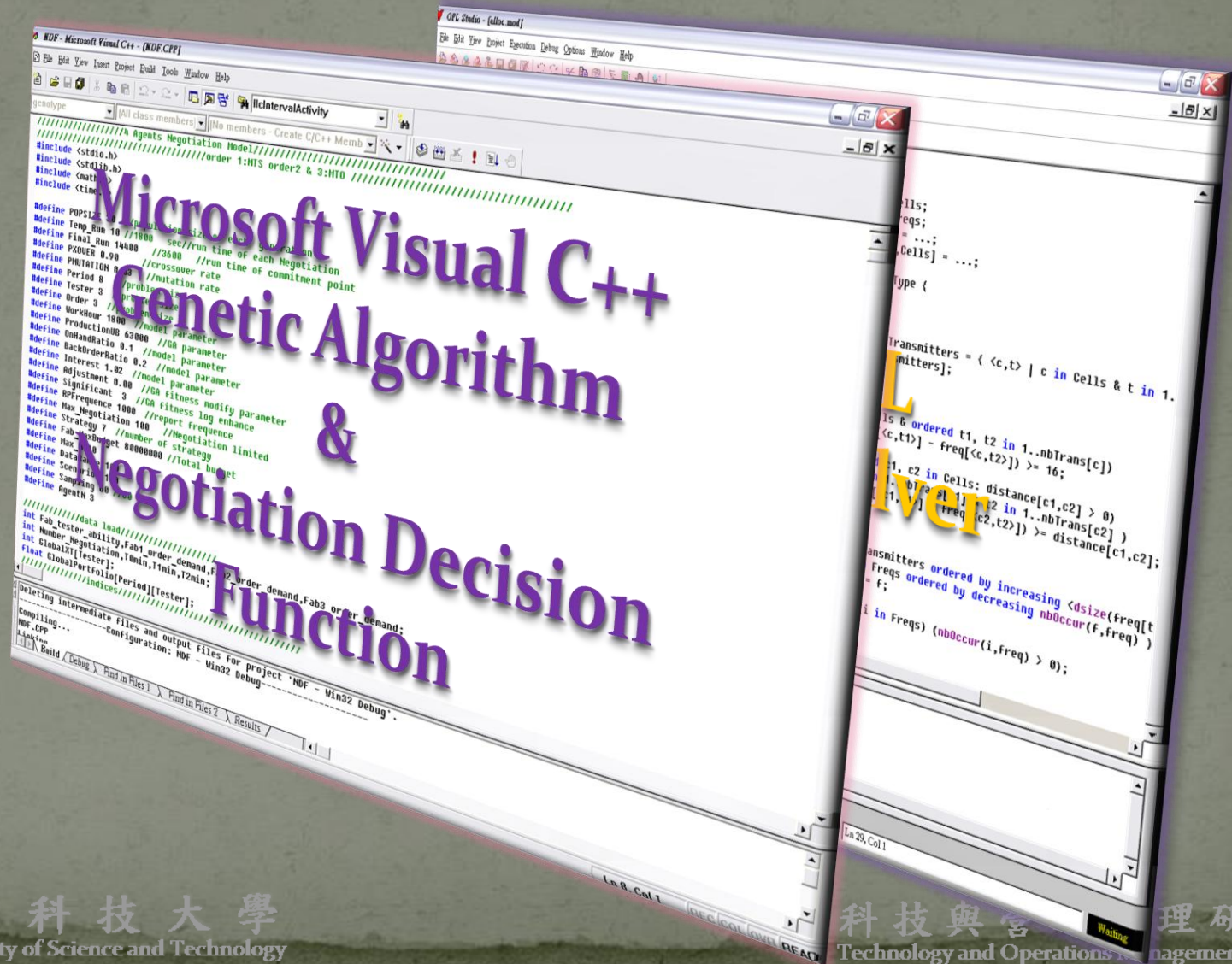


Minimize Wastage of Glass Substrate

Negotiation

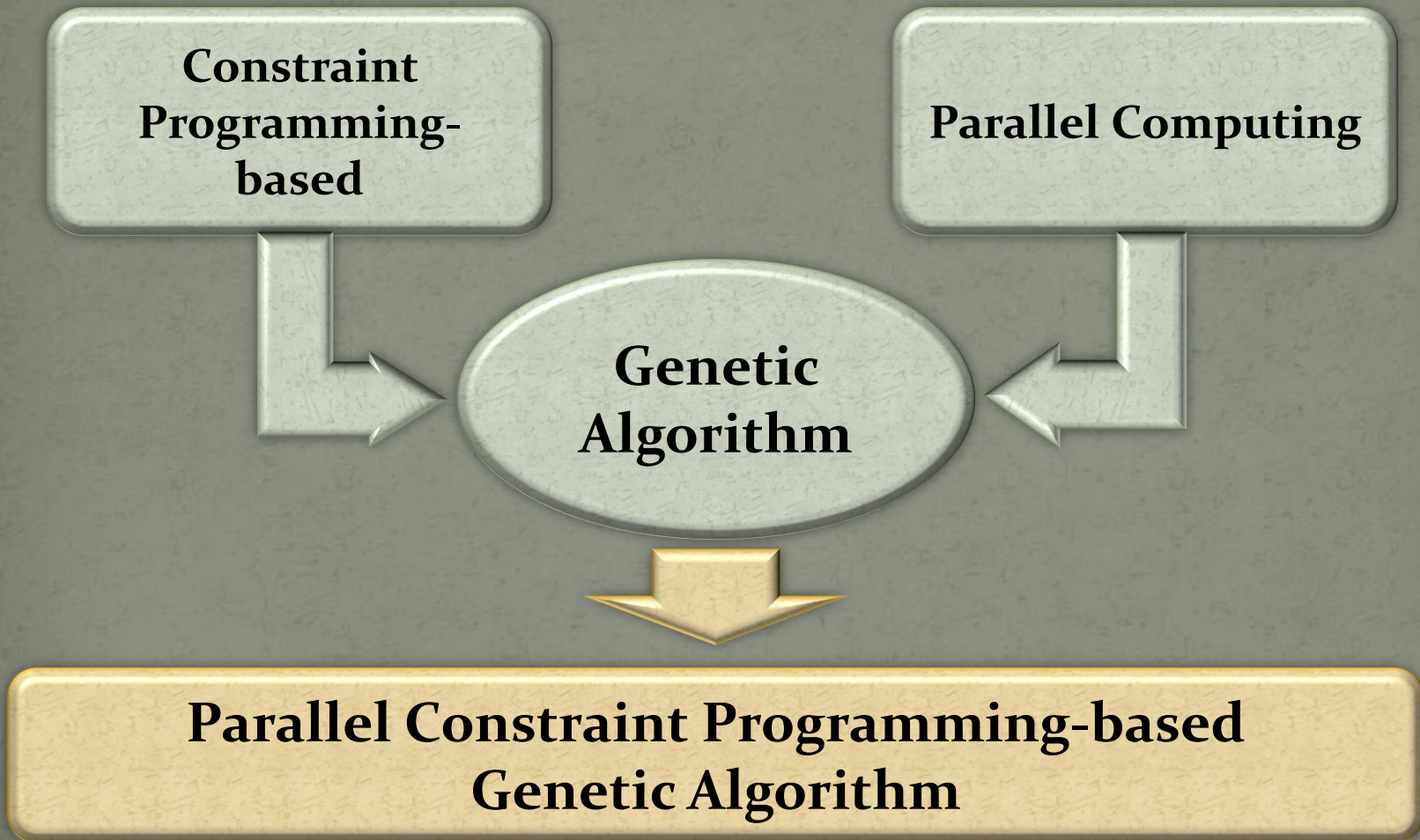


# Tools & Algorithms



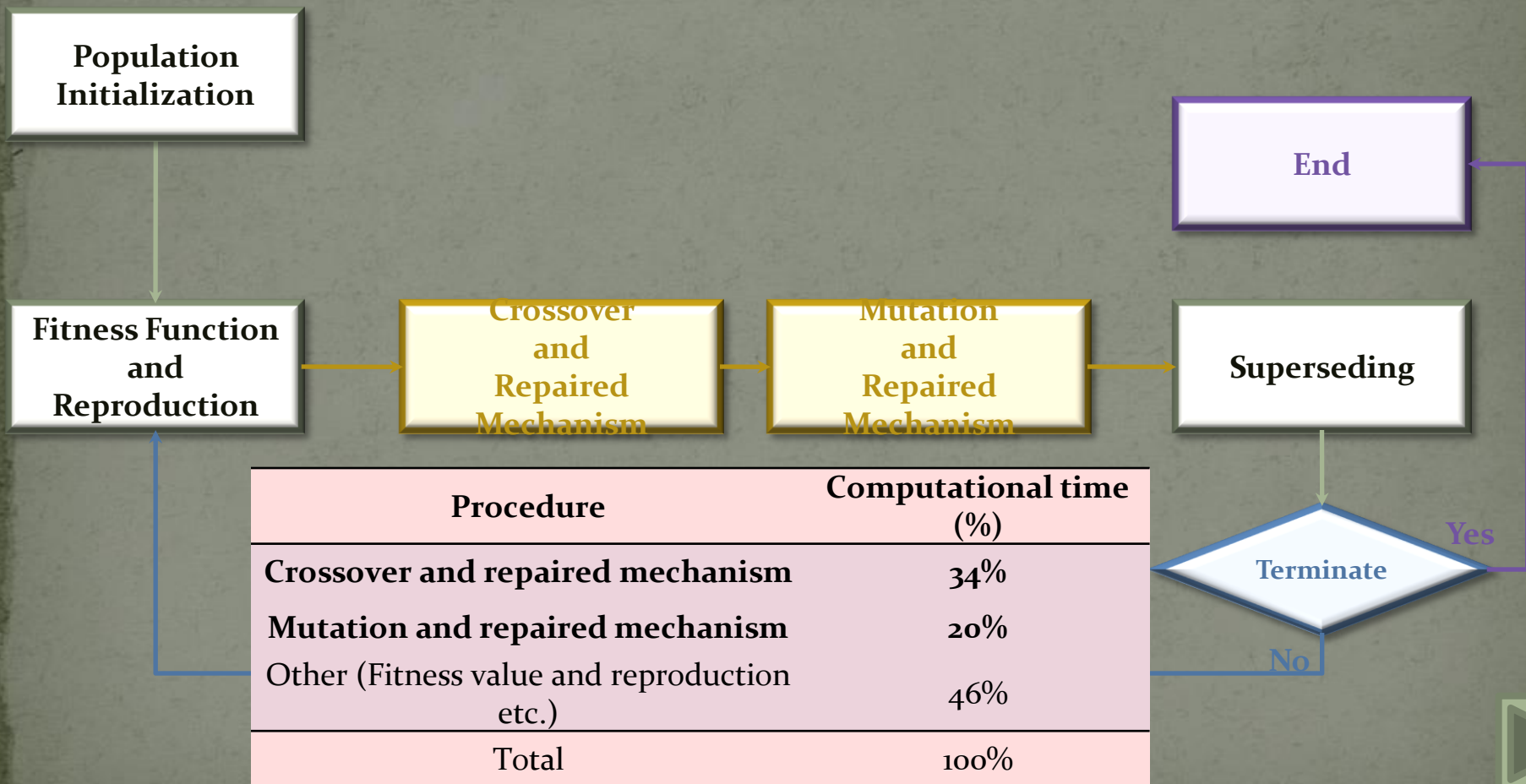


# Parallel Constraint Programming-based GAs

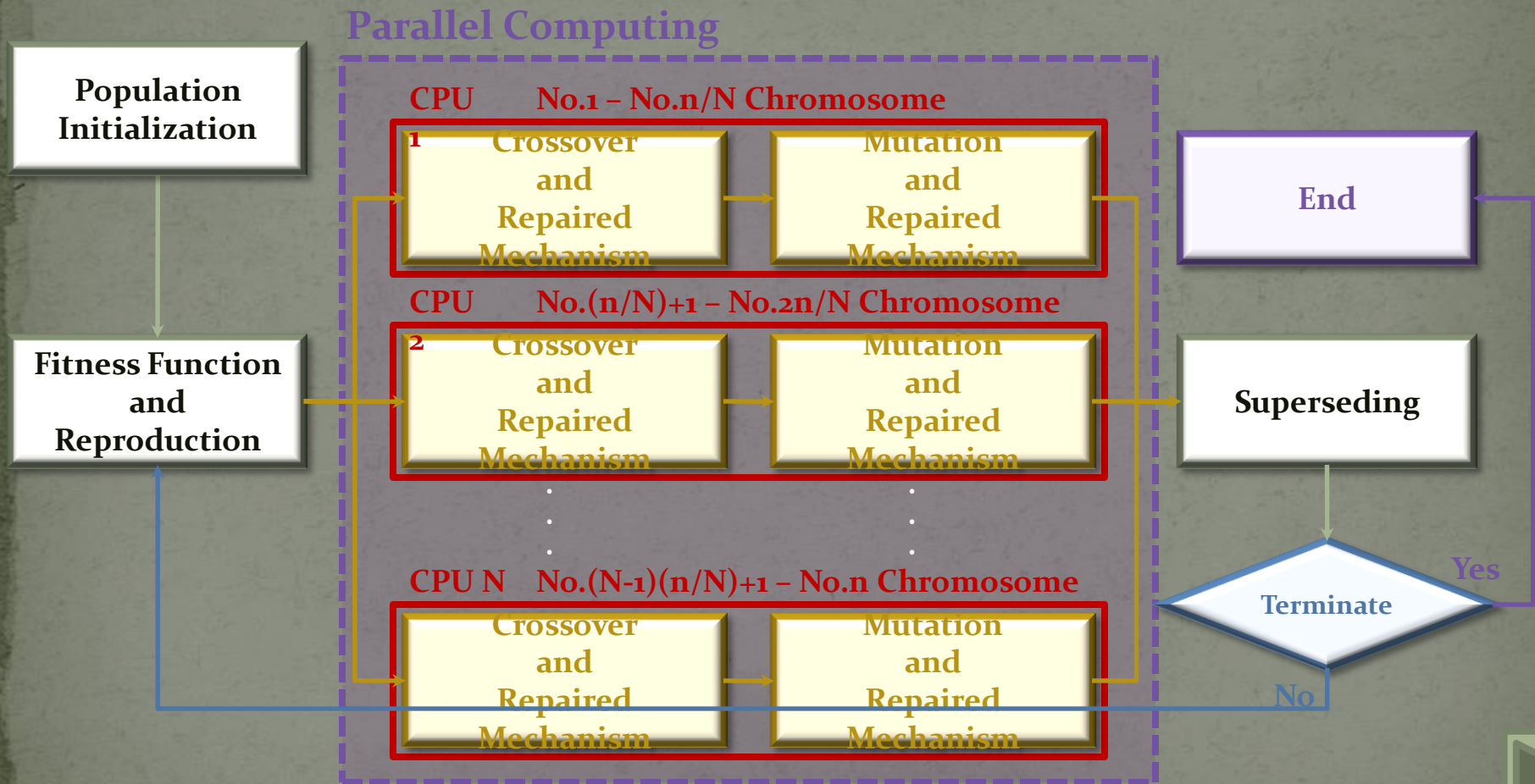




# Parallel Constraint Programming-based GAs



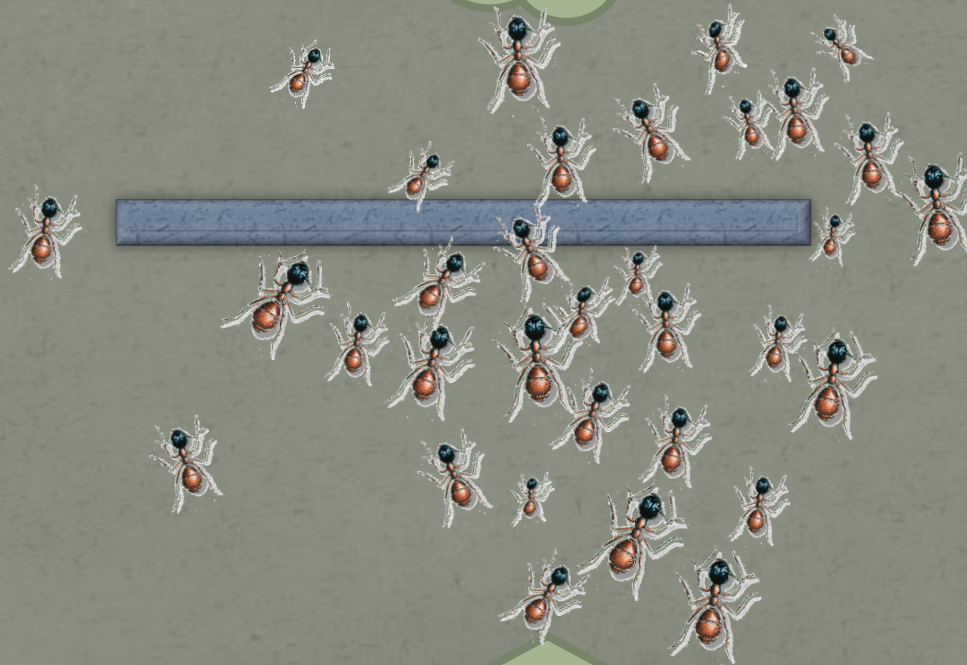
# Parallel Constraint Programming-based GAs



# Concept of Ant Algorithms



Food



Nest



# Experiment Result

## Simple Problem

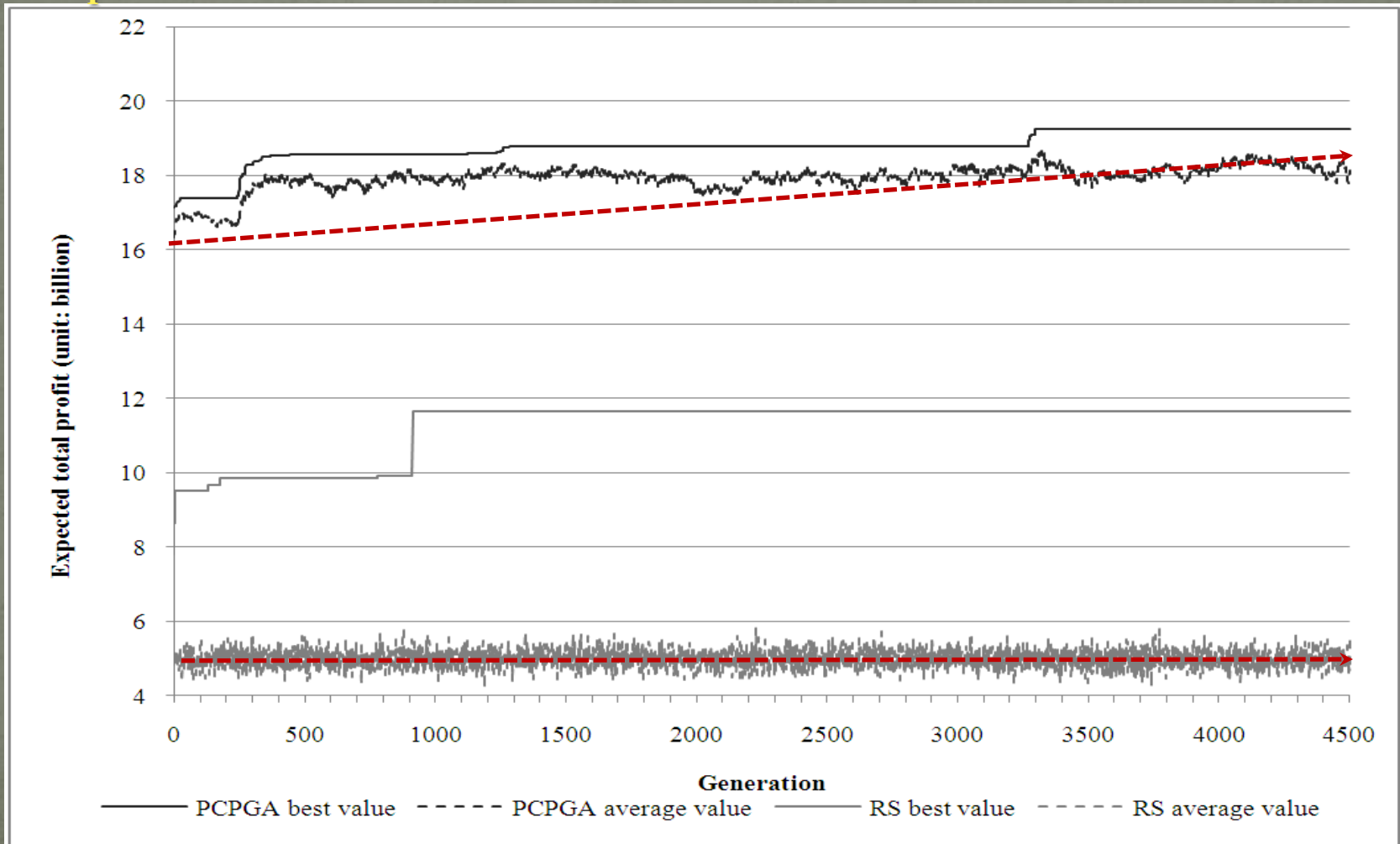
Method	ILOG	PCPGA	Random Search
Expected total revenue	159,104,053	159,673,832	151,317,139
Expected total substrate cost	32,798,000	33,578,000	38,410,000
Total transportation cost	2,868,667	2,889,630	2,729,775
Expected total holding cost	76,734	551,891	332,732
Expected total shortage cost	418,194	152,944	1,995,296
<b>Expected total profit</b>	<b>122,942,458</b>	<b>122,501,366</b>	<b>107,849,336</b>
Difference (%)	(0.00%)	<b>(-0.36%)</b>	(-12.28%)

## Complex Problem

Method	ILOG	PCPGA	Random Search
Expected Total Revenue	Unavailable	128,007,780,514	103,024,840,959
Total Glass Cost	Unavailable	107,254,680,000	87,382,150,000
Total Transport Cost	Unavailable	953,559,769	726,306,852
Expected Total Holding Cost	Unavailable	19,565,861	18,672,951
Expected Total Shortage Cost	Unavailable	519,460,200	3,242,837,598
<b>Expected Total Profit</b>	<b>Unavailable</b>	<b>(A) 19,260,514,200</b>	<b>(B) 11,654,873,537</b>
<b>Improvement (%)</b>	--	<b>[(A) - (B)]/(B) = (65.26%)</b>	--
<b>Run Time</b>	<b>Exceed 24 hours</b>	<b>13min 24sec</b>	<b>5min 31sec</b>

# Experiment Result

## Complex Problem



# Experiment Result

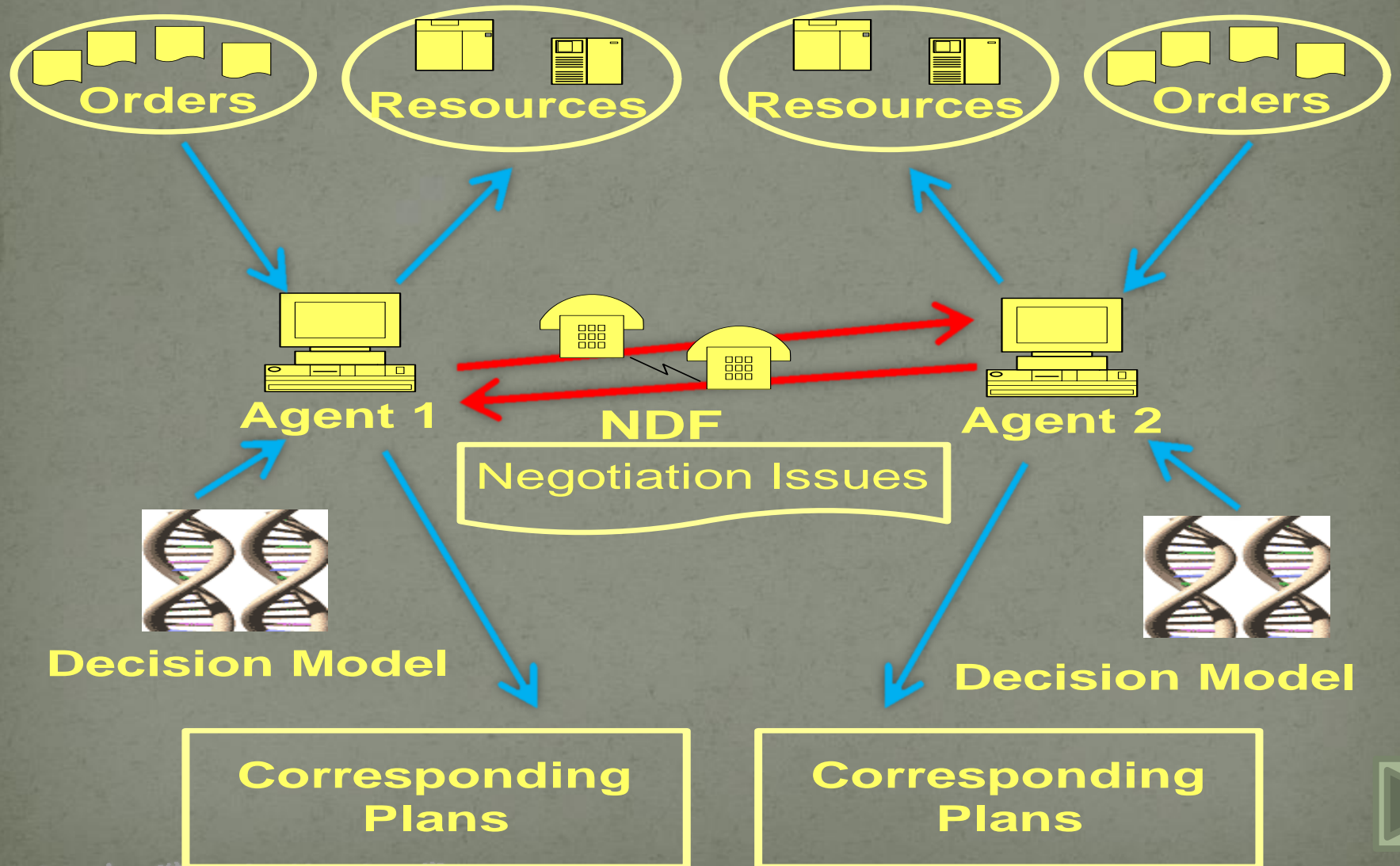
## Complex Problem

Procedure	Parallel Computing (seconds) (A)	Sequential Computing (seconds) (B)	Improvement (B-A)/B
Crossover and repaired mechanism	214	361	40.72%
Mutation and repaired mechanism	123	212	41.98%
Other (Fitness value and reproduction etc.)	487	489	0.00%
Total	824	1062	22.41%

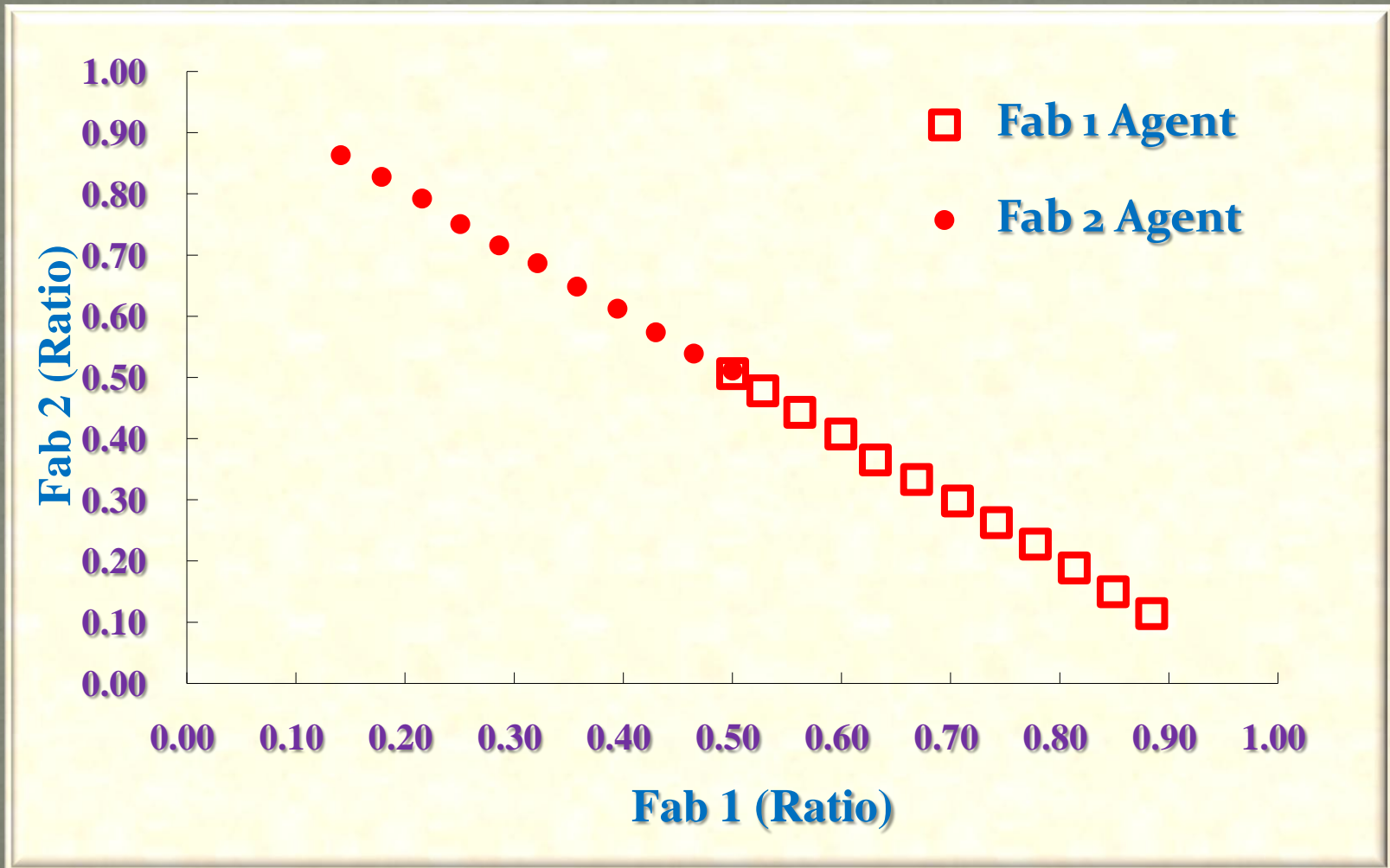
$$\begin{aligned}
 \text{Efficiency of parallel implementation} &= \frac{\text{Practical efficiency}}{\text{Theoretical efficiency}} \\
 &= \frac{22.41\%}{100\% \times 54\%} \\
 &= 41.5\%
 \end{aligned}$$



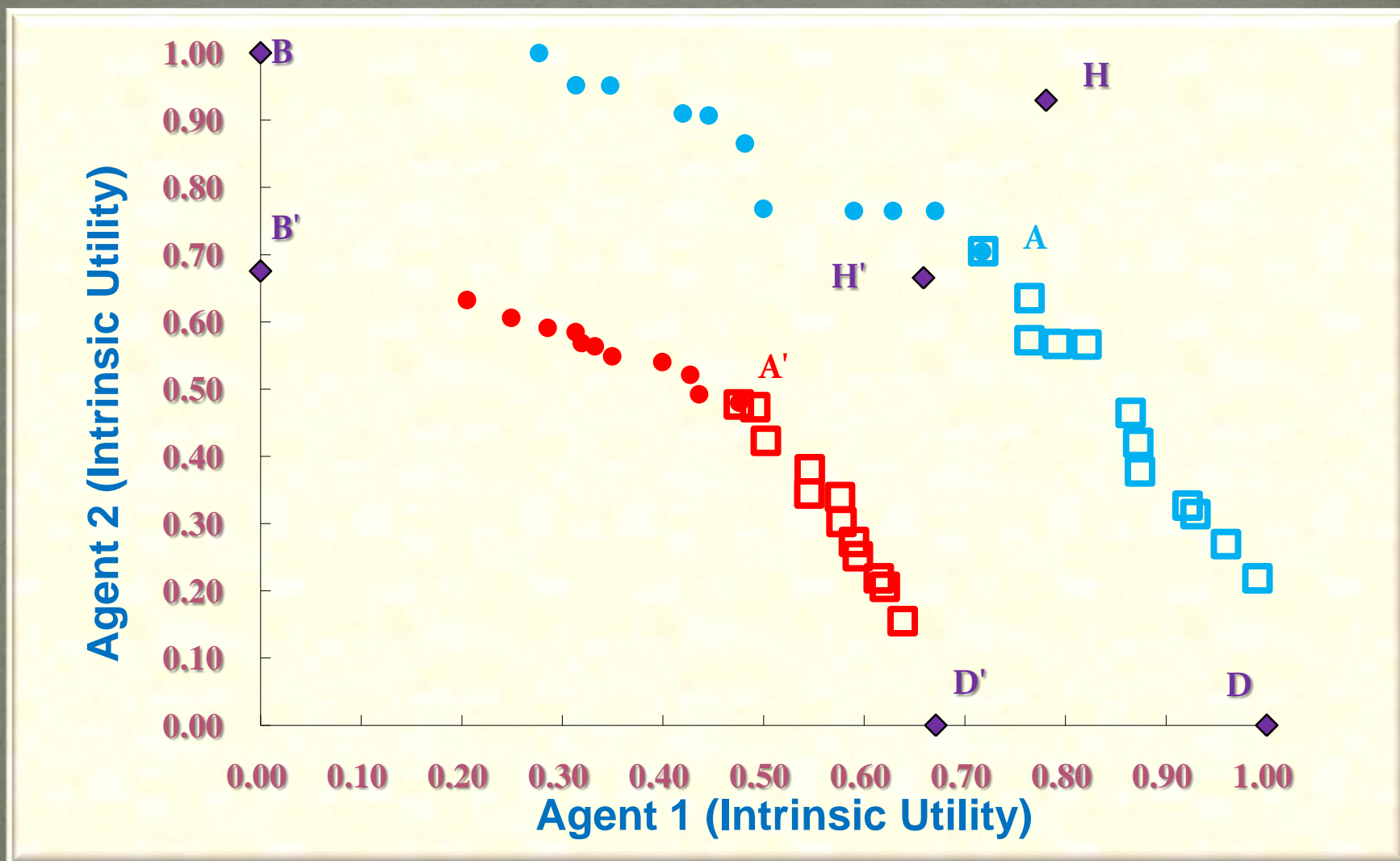
# Negotiation Based Capacity Planning Framework



# Illustration



# Illustration





# Publications

## • Journal Papers

- K. J. Wang, S. M. Wang, J. C. Chen, 2008, A Resource Portfolio Planning Model Using Sampling-Based Stochastic Programming and Genetic Algorithm, European Journal of Operational Research, Vol. 184, No.1, pp. 327-340 (SCI).
- S. M. Wang, J. C. Chen, and K. J. Wang, 2007, Resource Portfolio Planning of Make-to-Stock Products Using a Constraint Programming Based Genetic Algorithm, OMEGA-International Journal of Management Science, Vol. 35, No. 2, pp. 236-246 (SCI, SSCI, EI).
- K. J. Wang, S. M. Wang, and S. J. Yang, 2007, A Resource Portfolio Model for Equipment and Allocation of Semiconductor Testing Industry, European Journal of Operational Research, Vol. 179, No.2, pp. 390-403 (SCI)
- J. C. Chen, K. J. Wang, S. M. Wang, and S. J. Yang, 2007, Price Negotiation for Capacity Sharing in a Two-Factory Environment Using Genetic Algorithm, International Journal of Production Research (SCI, Accepted).
- S. M. Wang, K. J. Wang, J. C. Chen, and H. M. Wee, 2005, An Economic Capacity Planning Model Considering Inventory and Capital Time Value, Lecture Notes in Computer Science, Vol. 3483, No. 2, pp. 333-341 (SCI, EI).
- S. M. Wang, J. C. Chen, H. M. Wee, and K. J. Wang, 2005, Non-Liner Stochastic Optimization Using Genetic Algorithm for Portfolio Selection, International Journal of Operations Research, Vol. 3, No. 1, pp. 16-22.

# Publications

- **Conference Papers**

- **S. M. Wang**, K. J. Wang, and J. C. Chen, 2005, An Economic Capacity Planning Model Considering Inventory and Capital Time Value, Proceedings of the International Conference on Computational Science and Its Application 2005, May. 9-12, Singapore.
- H. S. Gu, **S. M. Wang**, and K. J. Wang, 2002, Negotiation-Based Scheduling With Trade-Off Mechanism, The 4<sup>th</sup> Asia-Pacific Conference on Industrial Engineering and Management Systems, Dec. 18-20, Taipei, Taiwan.
- K. J. Wang and **S. M. Wang**, 2009, A Negotiation-Based Capacity Planning Model, 20<sup>th</sup> Annual Conference of the Production and Operations Management Society, May. 1-4, Orlando, Florida.
- **S. M. Wang** and K. J. Wang, 2009, Autonomous Capacity Planning by Negotiation against Demand Uncertainty, Proceedings of the 16<sup>th</sup> ISPE International Conference on Concurrent Engineering, July. 20-24, Taipei, Taiwan.



# Publications

## • Patients

- 王孔政、王識閔，2008，半導體測試產業之同步資源規劃與產能配置系統(台灣、美國專利申請中)。
- 王孔政、王識閔、林靜敏，2008，TFT-LCD面板製造產業之多目標產能規劃決策系統(台灣、美國專利申請中)。
- 王孔政、王識閔、陳朝政，2008，TFT-LCD面板製造產業跨國運籌與資源配置系統(台灣、美國專利申請中)。

## • Projects

- 行政院國家科學委員會專題研究計畫 計畫名稱:設備/技術投資與資源分派之最適化決策以提昇TFT-LCD產業資源配置效益之前瞻研究，自九十四年八月一日起至九十七年七月三十一日止(三年期計畫)。
- 行政院國家科學委員會專題研究計畫(NSC-92-2213-E-033-037) 計畫名稱:智慧代理人之規則學習系統---以半導體測試產業之產能規劃為例，自九十二年八月一日起至九十四年七月三十一日止(兩年期計畫)。
- 行政院國家科學委員會專題研究計畫(NSC-91-2213-E-033-041) 計畫名稱:在多資源衝突下之智慧型代理人產能分派與生產排程系統--以半導體測試產業為研究與實證對象，自九十一年八月一日起至九十二年七月三十一日止。
- 行政院國家科學委員會專題研究計畫(NSC-90-2218-E-033-001) 計畫名稱:自主式製造系統協商機制之設計，自九十年八月一日起至九十一年七月三十一日止。
- 行政院國家科學委員會專題研究計畫(NSC-89-2213-E-033-058)，計畫名稱:以智慧型代理人技術為基礎之生產規劃與控制決策支援系統，自八十九年八月一日起至九十年七月三十一日止。



# Publications

## ● Working Papers

- K. J. Wang, and S. M. Wang, 2008, Resource Portfolio Planning Under Demand and Technology Uncertainty in High-Tech Manufacturing Industry.(OMEGA)
- K. J. Wang, and S. M. Wang, 2009, A Negotiation-Based Capacity Planning Model.(Revision)
- K. J. Wang, S. M. Wang, and T.C. Chen, 2009, Capacity Planning for Multi-Stage TFT-LCD Supply Chain.(Editing)
- K. J. Wang, S. M. Wang, and J. M. Lin, 2009, An Agent-Based Negotiation Framework for Objective Conflict Solving in TFT-LCD Manufacturing Industry.(Editing)

# Graduated Students



Dobei Wang  
臺灣科技大學



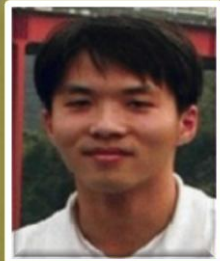
T.C. Hou  
日月光



Horance Chou



S. H. Lin  
聯電



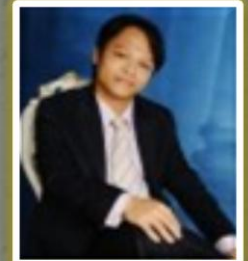
Hank Gu



M.H. Lu  
中科院



Ellis Siu



Albert Chen  
臺灣科技大學



方彥翔  
奇美電子



C.H. Chao  
中原大學



蔡政宏  
中國生產力中心



Chou-Cheng Chen  
服役中



Carol Lin  
科技與營運管理研究室  
Technology and Operations Management Laboratory



# Resources Planning & Capacity Allocation Team

## 資源規劃與產能分派團隊

---

Team Coordinator : Dr. Shih-Min Wang

Team Advisor : Dr. Kung-Jeng Wang