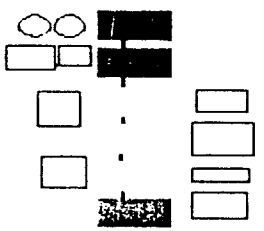
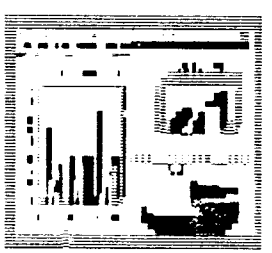
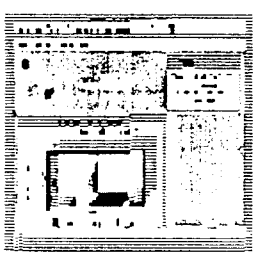
TOTAL CAPACITY MANAGEMENT:



A Continuous Manufacturing Improvement Solution





PRITSKER CORPORATION
AN OVERVIEW

- Founded in 1973 - Privately held

- Complete Design and Operations Decision Support Products
  - FACTOR for Operations
  - SLAM family for Design

- 5,000+ Product Licenses Worldwide

PRITSKER CORPORATION
AN OVERVIEW

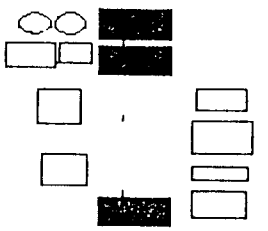
- Full Service Organization - 100 Employees
  - Scheduled public training
  - Affiliate technology transfer
  - End user problem consultation
  - Product installation
  - Continuing support and maintenance

PRITSKER CORPORATION
AN OVERVIEW

- Aggressive and Ongoing Product Development
  - 30 MY in Development in last year
  - Upgrades to all products in last year
  - New Product Development Activity

SUPPORT OF TCM

WHAT IS TCM?



I. A philosophy that allows manufacturers to collapse their value added chain

II. A capability that allows manufactuers to:

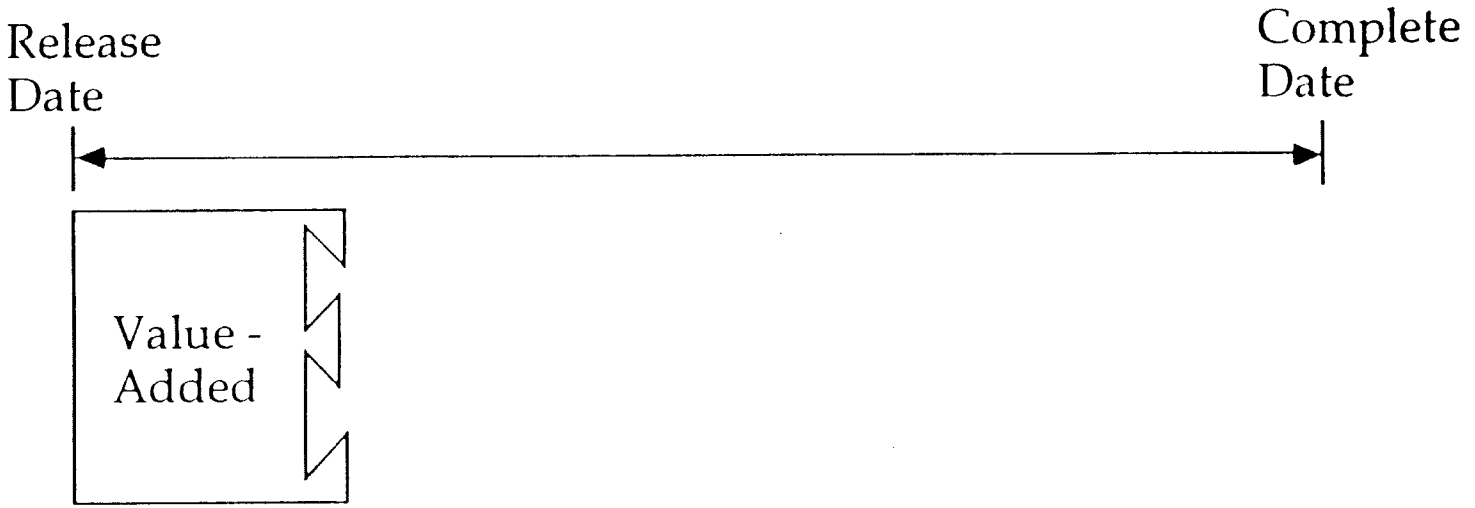
- Improve delivery date performance
- Shorten production cycle time
- Reduce costs

TCM APPROACH

I. Utilize an accurate understanding of operations for all planning and control functions

➡ Simulation Technology

Understanding the Dynamics of Capacity

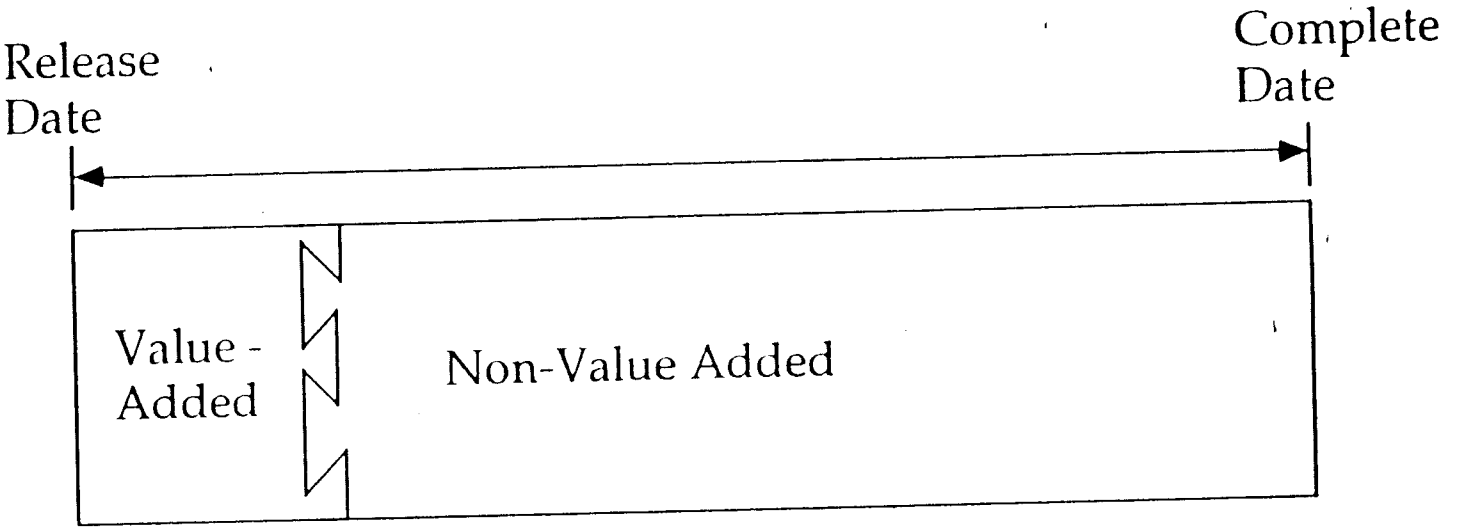


Machine Time:

- routings
- available hours
- time standards
- efficiencies

PRITSKER

Understanding the Dynamics of Capacity



Machine Time:

- routings
- available hours
- time standards
- efficiencies

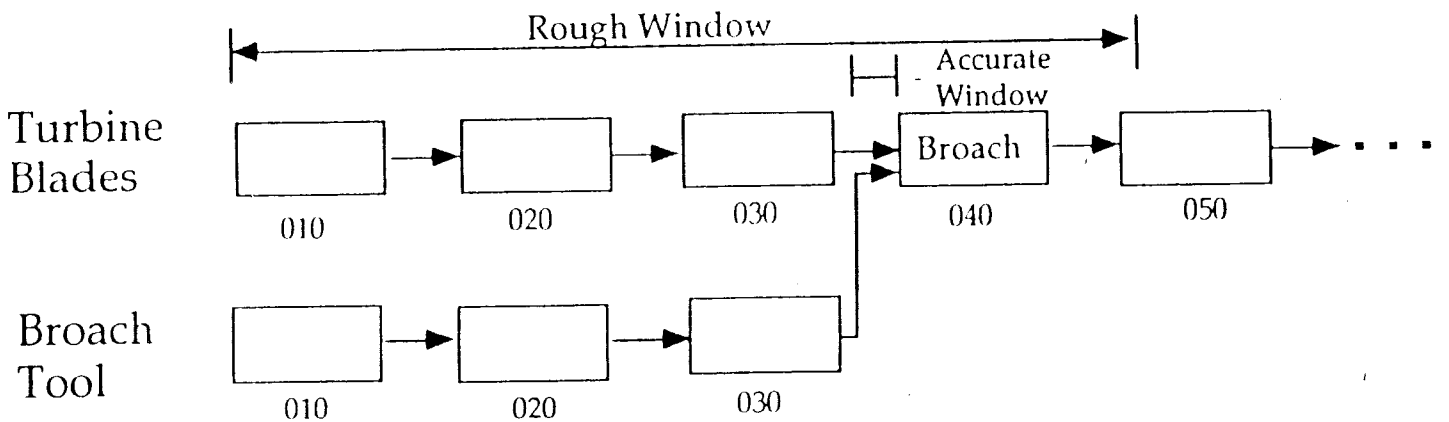
Queue & Move Time:

- workcenter busy
- raw materials unavailable
- intermediate materials unavailable
- tools, tapes, etc. unavailable
- setup, cleanup, teardown variable
- maintenance required
- transfer lot not complete
- process lot not complete

PRITSKER

CAP 030

TCM Principle 2: Logistics Illustration

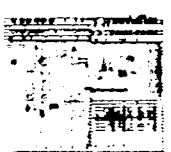


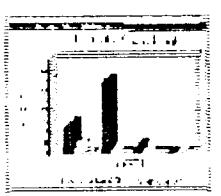
- Tooling better able to plan production, procurement, use
- Cost of building or buying too early avoided
- Cost of delivering too late avoided

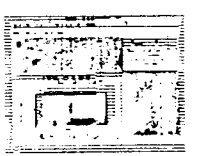
PRITSKER

WHAT IS SIMULATION

- Building a computer based model of your operation
- Exercising the model to see how the system will perform under varying conditions
- Using the model to control operations

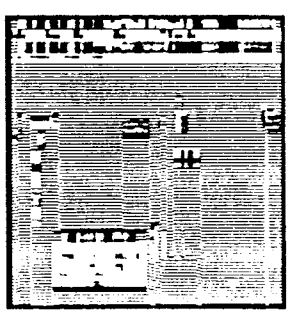






SIMULATION PROVIDES THE ABILITY TO REPRESENT:

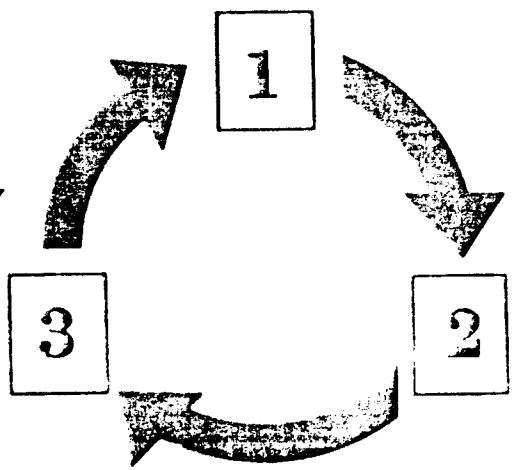
- Batching & Assembly Operations
- Sequence Dependent Setup
- Resource Combination Limitations
- Shift Scheduling & End of Shift Procedures
- Hueristic and Look Ahead Decision Logic
- Effects of Varying Congestion



The Scientific Method

Old Way

1. The real thing: Start with a problem and data



2. Theory: Develop hypotheses about problem and data

3. Testing: Test theory in the laboratory or real world

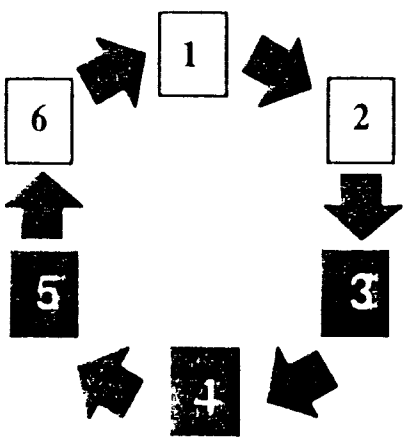
Source: Adapted from Cornell Engineering College information as presented in the Indianapolis Star, 7/20/1991.

The New Scientific Method

New method as applied to manufacturing systems

1. Manufacturing system: Start with a problem and data

■ New steps



2. Theory: Develop hypotheses about problem and data

3. Mathematical-logical model: Translate the theory into a mathematical-logical model

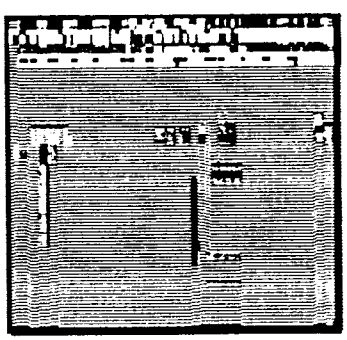
4. Computation: Run the model on a computer plugging in different variables to test alternatives

5. Visualization: Turn the model outputs and system data into pictures to give insight

6. Testing: Test the theory in the laboratory or real world

SURVEYS SHOW

Simulation is the most used and useful technique of industrial engineers and operations researchers.



Challenges
VOL. 2 NO. 6 COUNCIL ON COMPETITIVENESS APRIL 1989

Computer Simulation and Modeling

22 "Critical" Technologies Identified

The Departments of Defense and Energy have identified 22 technologies that are critical to national security and U.S. "weapons superiority." The 22 will be prime candidates for additional federal R&D funds.

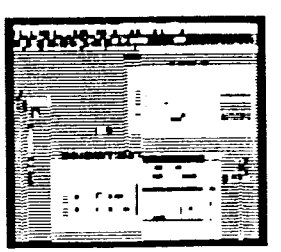
Although the immediate focus is on military preparedness, some commercial spinoff is likely from such projects as superconductors, biotechnology and microelectronics. Four criteria guided the selection, mandated by congressional legislation last year: an ability to significantly enhance the performance of existing weapons; the potential to create new capabilities; the potential to improve reliability, availability and "maintainability"; and affordability. The report was quick to point out that the list is not final, that "a sputnik-like surprise or an unexpected surge in terrorist activity" could cause changes. ■

Targeted Technologies

Microelectronic circuitry
Preparation of gallium arsenide and other compound semiconductors
Software design productivity
Parallel processing for high-speed computing
[redacted]
Computer simulation and modeling
[redacted] circuits and computers
Fiber optics
Sensitive radars that can detect stealth-type aircraft
Passive sensors that can monitor equipment without emitting a signal
Automatic target recognition that uses artificial intelligence to classify targets
Phased arrays for radar detection
Data fusion machines that process raw data into more convenient forms
Signature controls that make stealth weapons less visible to radar
Computational fluid dynamics that use computers to simulate the flow of liquids or gases
Air breathing propulsion to improve jet-engine efficiency
High-power microwaves for use as weapons
Mobile high-power lasers
Kinetic kill energy to fire projectiles at ultra-high speeds
Lightweight composite materials
Superconductivity
Biotechnology materials and processing

WHY SIMULATION WORKS

- Realistic models built for a purpose
- Validation is performed
- Engineering concepts are used
- Decisions made using simulation have a proven track record of cost savings



TCM APPROACH

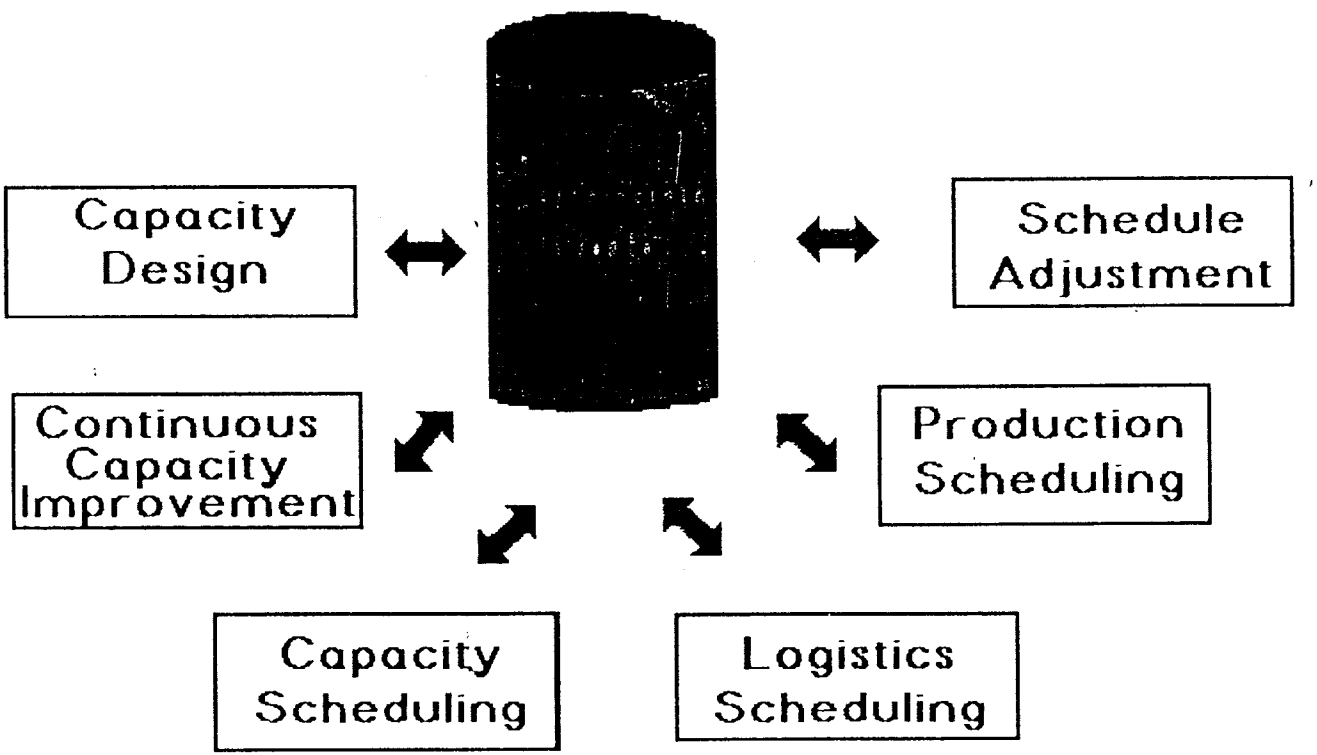
I. Utilize an accurate understanding of operations for all planning and control functions

→ Simulation Technology

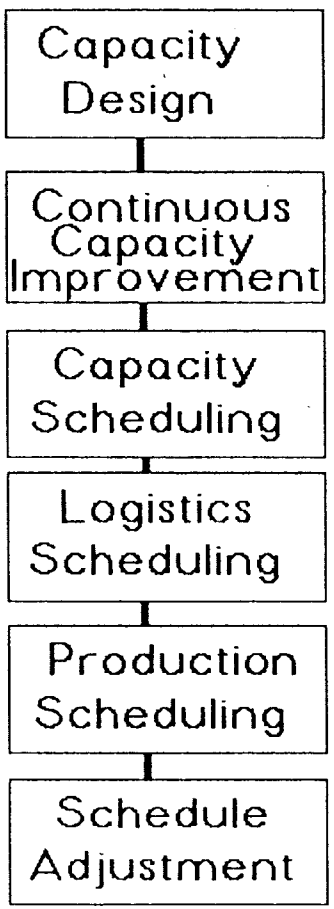
II. Foster consistency within the decision making process through a common understanding of operations

→ Common Modeling Language

TCM APPROACH



TCM FUNCTIONS



- How should the system be implemented?
- How can the system performance be improved?
- How much capacity is needed? When? Where?
- When are materials, tools, etc. needed?
- What are the resource–job assignments? Sequences?
- How do dynamic changes impact the schedule?

A Manufacturing Model

- **Resources**

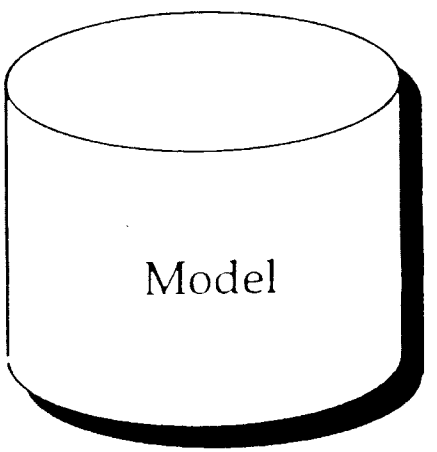
  Machines
  Material Handling Systems
  Work-in-process areas
  Personnel
  Fixtures
  Tooling

- **Material**

- **Parts**

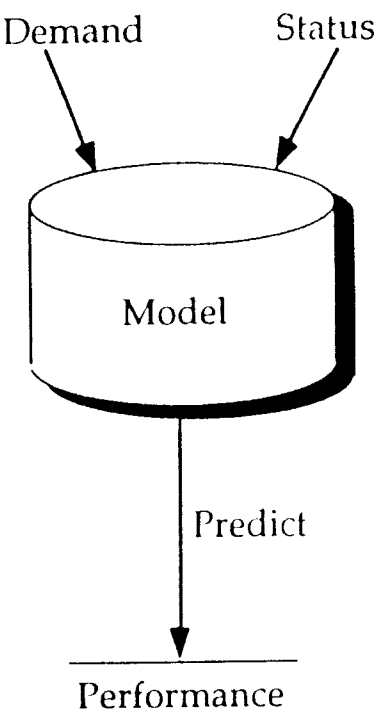
- **Process plans**

- **Methods/Rules**



PRITSKER

Decision Support Process



- Performance to due date
- Throughput
- Inventory levels
- Resource utilization
- Cost

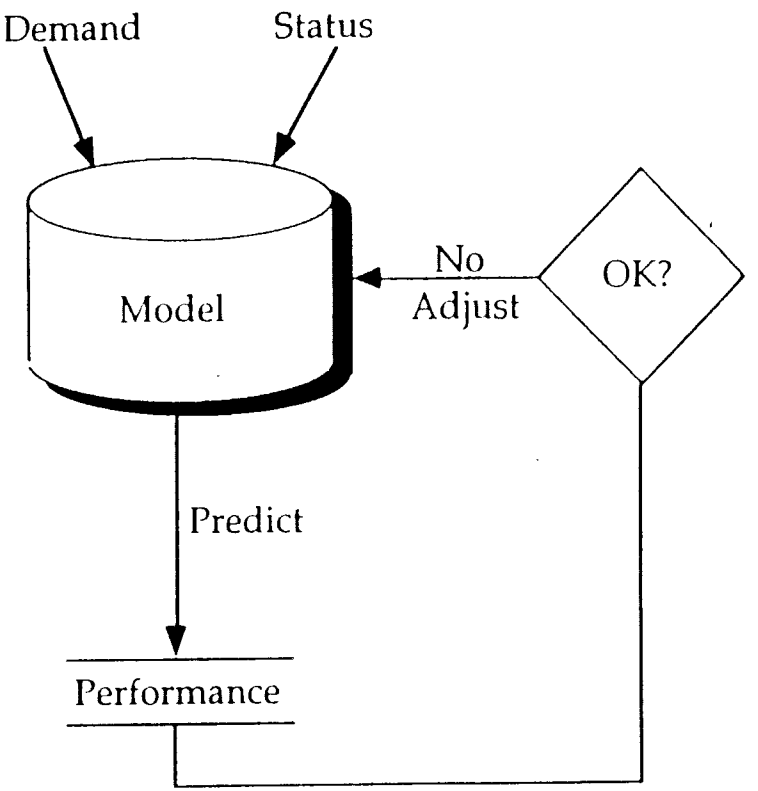
Order Summary

FACTOR Order Summary Comparison

Date: 04-10-91 08:53 Model:

Altern Number	Order/ID Part Number	Order Size	Waiting Time	Process Time	Start Date	Due Date	Complete Date	Comp Flag	Lateness
01	0003 PART0500 0500	300	18.612	8.037	11-10-91 07:30	11-17-91 16:30	11-14-91 10:09	Y	-78.351
02	0004 PART0500 0500	300	18.612	8.037	11-10-91 07:30	11-17-91 16:30	11-14-91 10:09	Y	-78.351
01	0005 PART0600 0600	350	22.288	17.142	11-10-91 07:30	11-17-91 16:30	11-14-91 22:56	Y	-65.570
02	0006 PART0600 0600	350	31.650	17.142	11-10-91 07:30	11-17-91 16:30	11-15-91 8:18	Y	-56.208
01	0007 PART0200 0200	250	181.363	13.158	11-10-91 07:30	11-20-91 16:30	11-21-91 10:01	Y	17.520
02	0008 PART0200 0200	250	60.869	11.480	11-10-91 07:30	11-20-91 16:30	11-16-91 07:51	Y	-104.652
01	0009 PART0300 0300	100	199.426	25.207	11-10-91 07:30	11-20-91 16:30	11-22-91 16:08	Y	47.632
02	0010 PART0300 0300	100	91.952	7.883	11-10-91 07:30	11-20-91 16:30	11-17-91 11:20	Y	-77.165

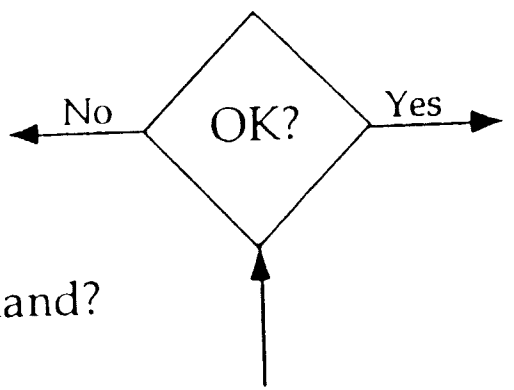
Decision Support Process



- Performance to due date
- Throughput
- Inventory levels
- Resource utilization
- Cost

Decision Support Questions - Actions

- Can due dates be met with a better sequence?
  → Change sequence priority rules.



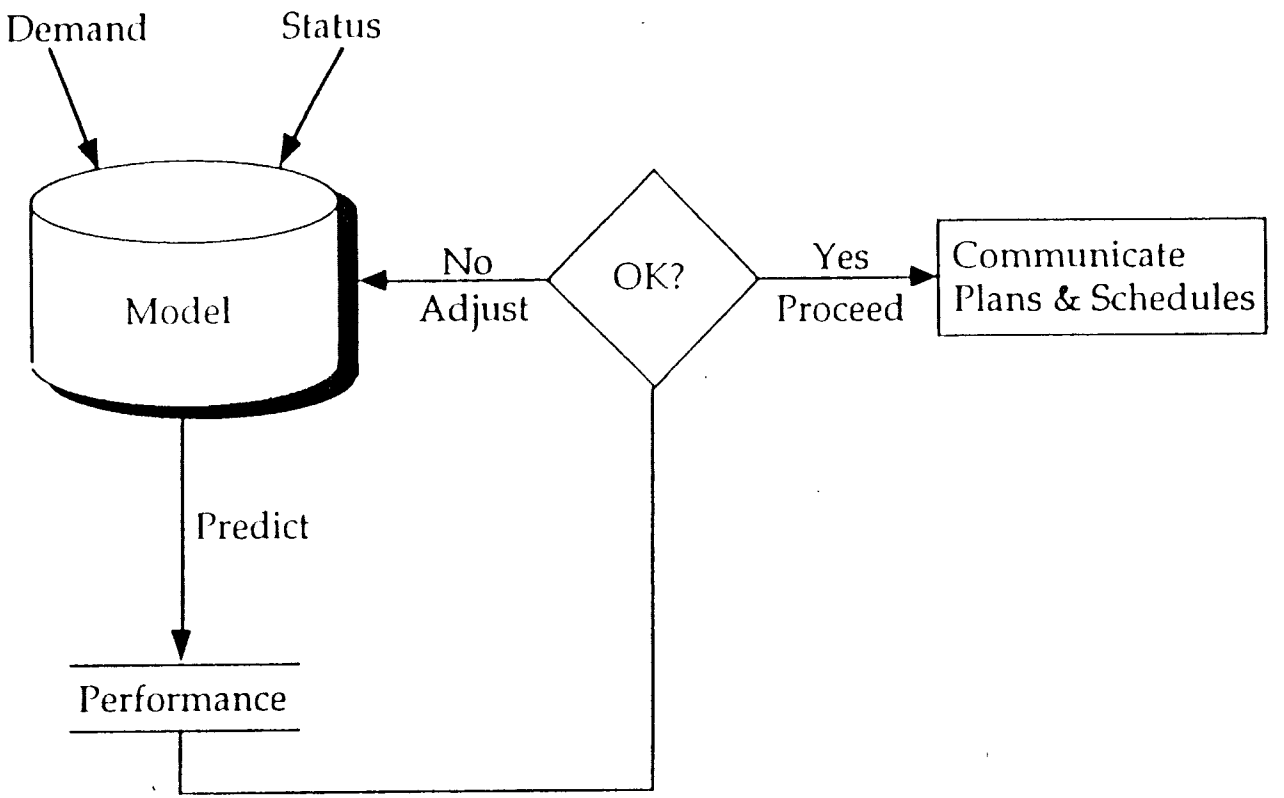
- Can tools be delivered on time?
  → Set the requirement date.

- Should overtime be worked to meet demand?
  → Add a Saturday shift.

- Should a workcenter be upgraded for higher volume?
  → Change the production rate.

PRITSKER

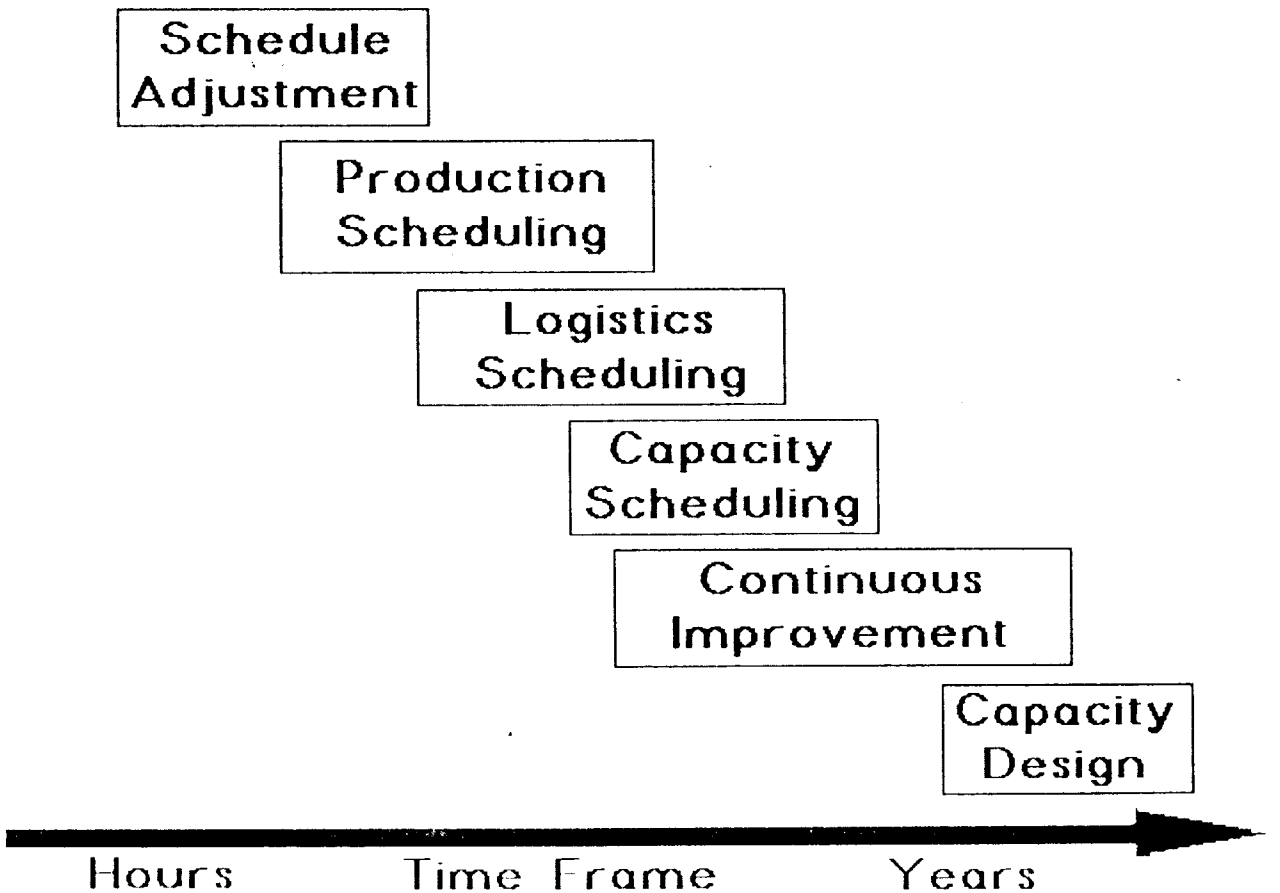
Decision Support Process



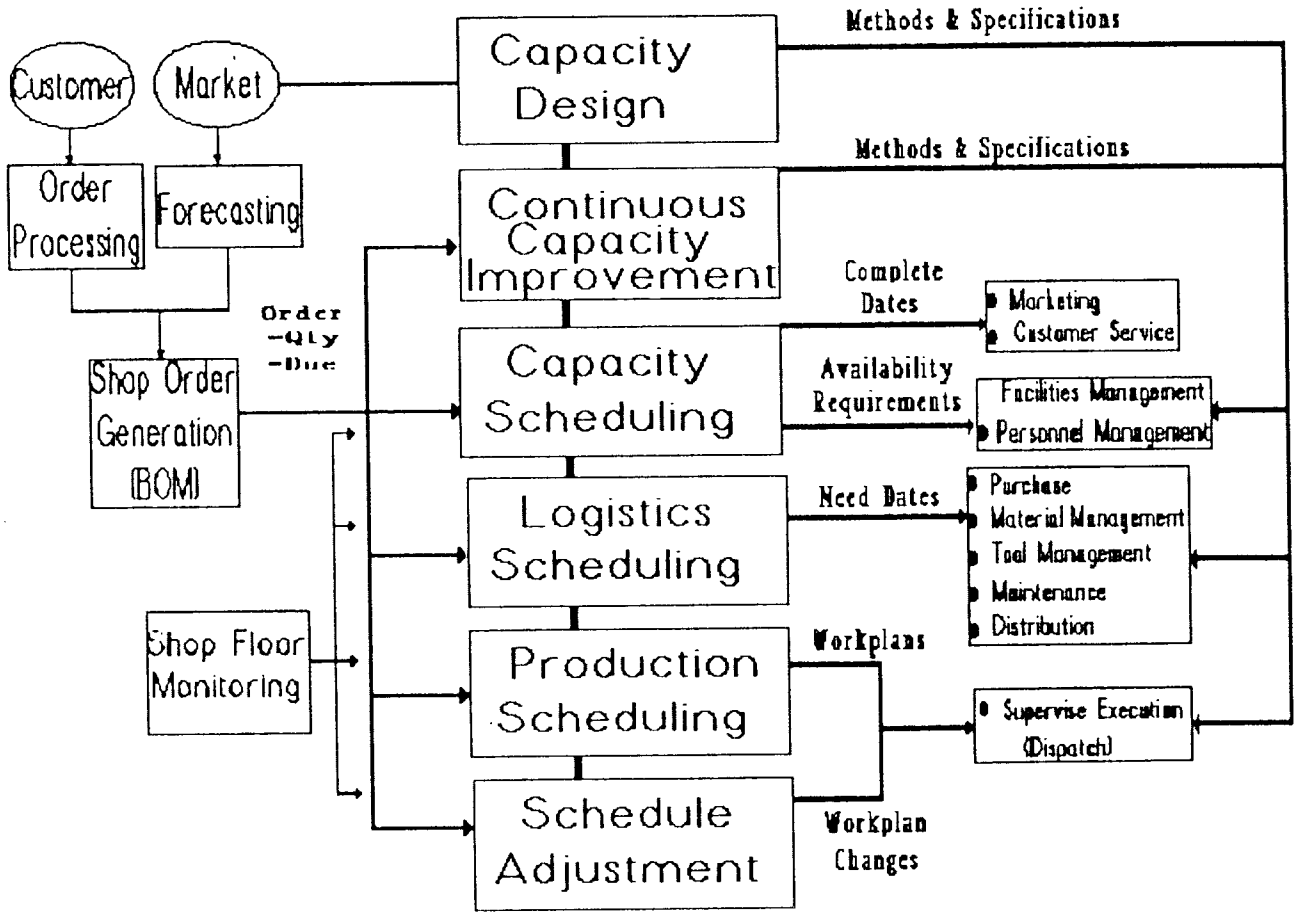
- Performance to due date
- Throughput
- Inventory levels
- Resource utilization
- Cost

PRITSKER

TCM TIME FRAME BY FUNCTION



A MODEL ARCHITECTURE FOR TCM



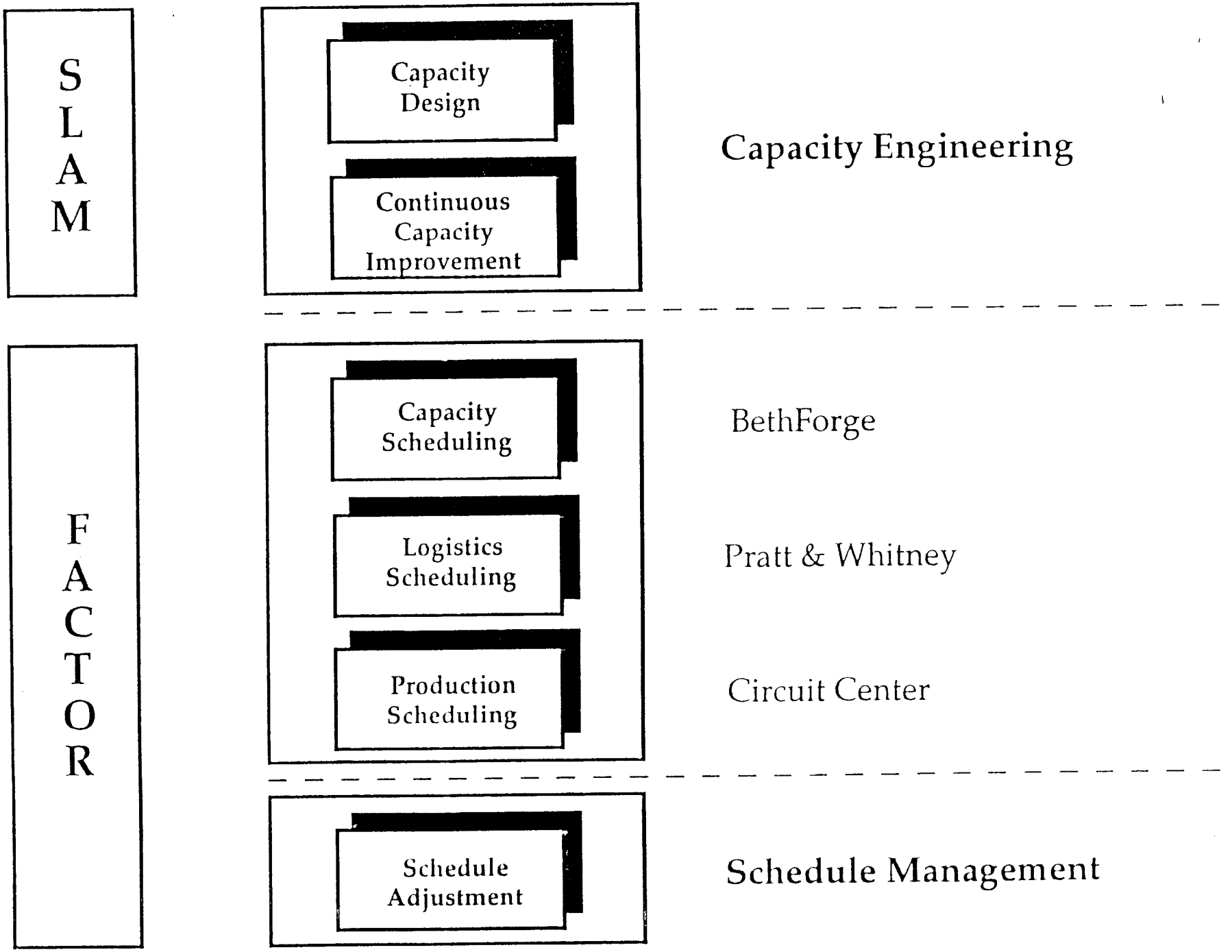
Capacity Management Produces Results

Customer Examples:

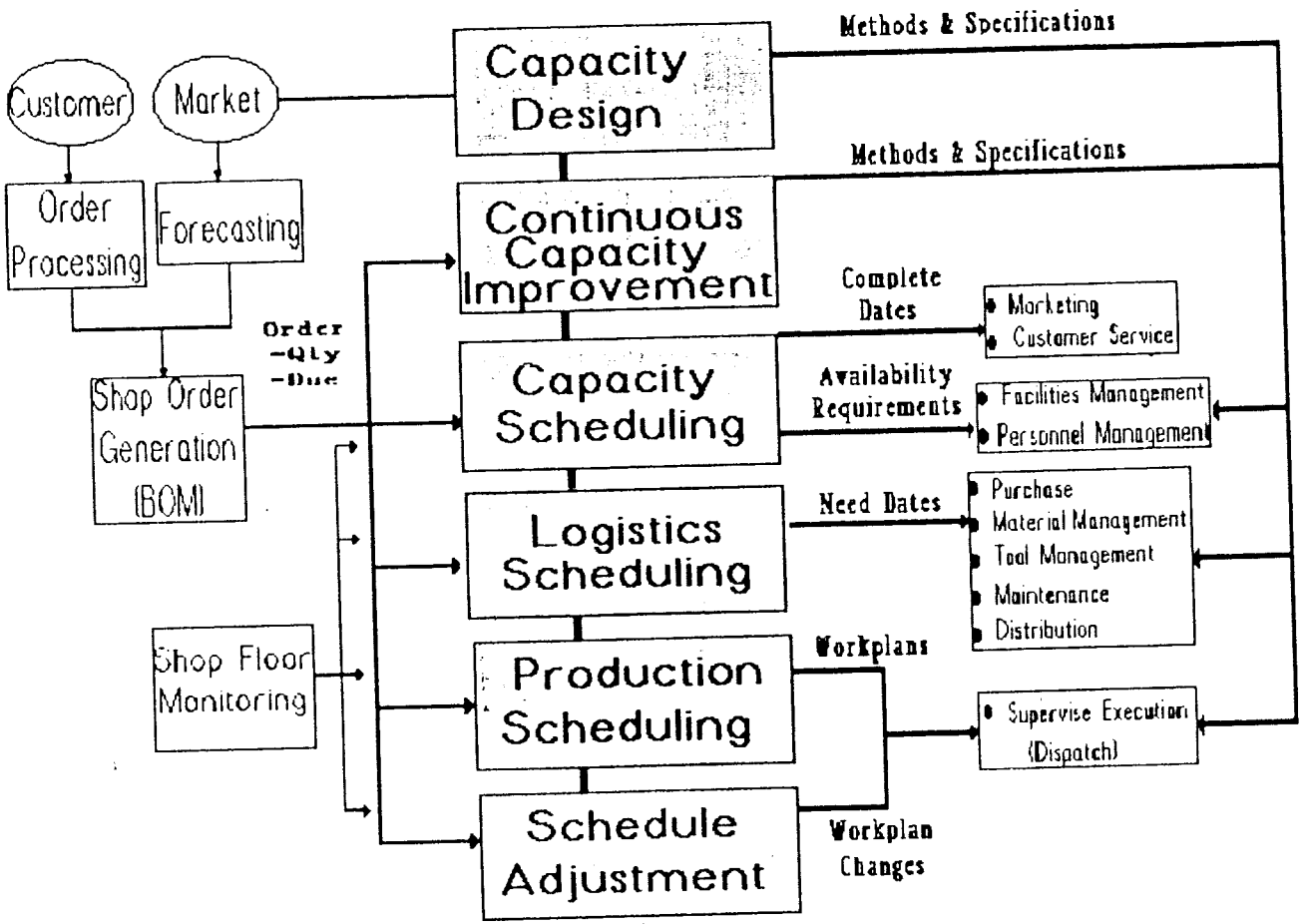
- $884,000 annual revenue increase on one line
- Parts shortages reduced from 60% to 13%
- Premium labor reduced 50%
- Work in process inventory reduced 70%
- Annual expendable tooling costs reduced $1.2 million
- Annual premium shipping costs reduced $200,000
- Capacity engineering project provided 25:1 ROI

PRITSKER

Pritsker Software Fully Supports ICIM



FACTOR 5.0


Customer
Market
Order Processing
Forecasting
Shop Order Generation (BOM)
Order -Qty -Due
Shop Floor Monitoring
Capacity Design
Methods & Specifications
Continuous Capacity Improvement
Methods & Specifications
Capacity Scheduling
Complete Dates
Marketing
Customer Service
Availability Requirements
Facilities Management
Personnel Management
Logistics Scheduling
Need Dates
Purchase
Material Management
Tool Management
Maintenance
Distribution
Production Scheduling
Workplans
Supervise Execution (Dispatch)
Schedule Adjustment
Workplan Changes