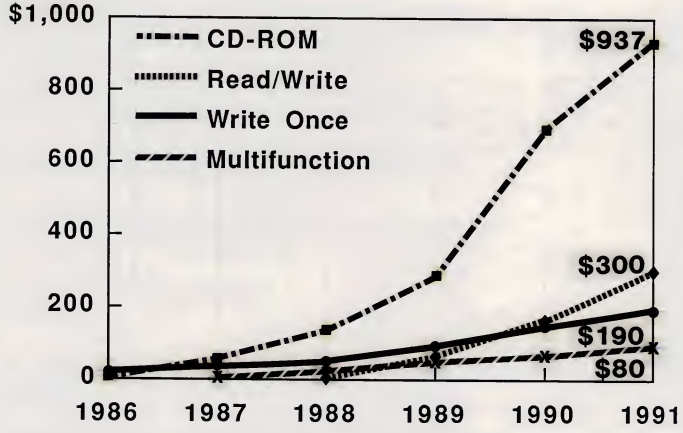
OPTICAL DISK MARKETS, 1986-1991
($ Millions)



JJJJ GK(2) J(s)41

Scotch® 7664 "Post-it" Routing-Request Pad

ROUTING - REQUEST

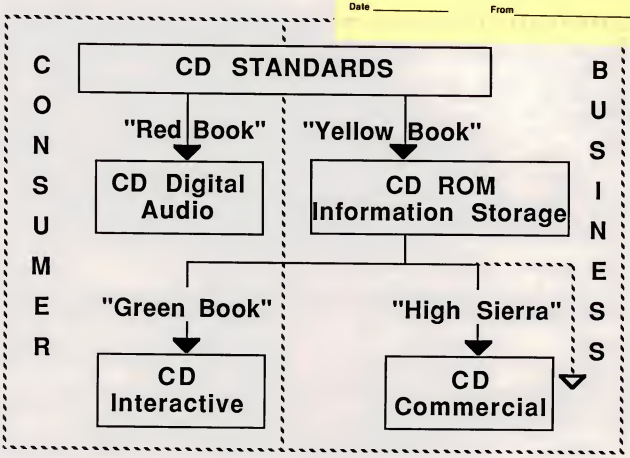
Please
- ☐ READ
- ☐ HANDLE
- ☐ APPROVE

and
- ☐ FORWARD
- ☐ RETURN
- ☐ KEEP OR DISCARD
- ☐ REVIEW WITH ME

Date _____

To For CD-ROM Presentation need slides

From _____



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COMPUTER INTEGRATED MANUFACTURING MARKETS, 1986-1990

Graham Kemp
Vice President
INPUT

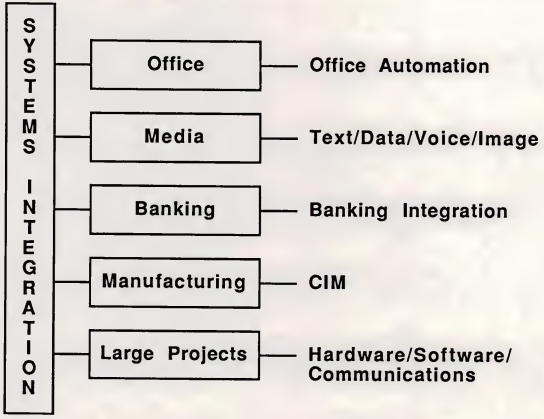
1 JJJJ GK2 J(s)

CIM: WHO NEEDS IT?

- 268,000 Manufacturing Plants in the U.S. (SIC Codes 20-39)
- 230,000 Have Less than 100 employees
- 75% Are Job Shop Manufacturers
- 15,000 Have More than 200 Employees
- 10,000 MRP Systems Installed

CIM

- Misnomer?
- CIM Is Systems Integration Applied to the Manufacturing Environment
- CIM and Automation Not Synonymous - (Process Integration Not Just Technology Integration)



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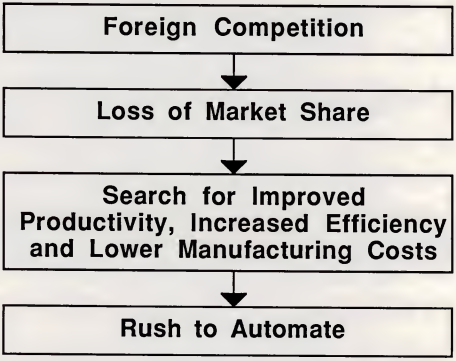
WHY CIM?

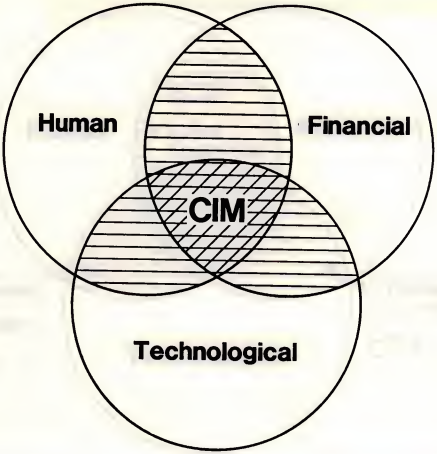


Year	Planning/ Admin.	Product Design	Mfg.	Shop Floor
1980	• MRP II			• JiT • Robotics • AI
1970	• Group Tech. • MRP		• CAD/ CAM • Simulation	• FMS • CNC/DNC
1960	• Process Planning	• CAD	• CAM	• Programmable Controls
1950	• Inventory Control	• Drafting		

MANUFACTURING REALITIES 1986

- Shorter Product Life Cycle, Production Runs
- Broader Product Mix
- Higher Quality, Lower Costs Needed
- Drive for Customer Responsiveness
- [Team Spirit, Consensus Decision Making]

CIM INTEGRATION



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CIM GOALS

- Convert Batch Processes → Continuation of Real Time Processes
- Integrate Manufacturing Decision Making with Variable External Demand
- Integrate Manufacturing Processes
- Improve Quality/Productivity, Reduce Costs

CIM: LIMITED MARKET - SO FAR

- Costly Strategic Option
- Large Corporation Option
- Piecemeal Adoption Possible
- Outsourcing?

CIM MARKETS

CIM CAVEATS

- Easier to Talk about "Islands of Automation" (CAD/CAE, CAM, MRPII, Robotics, AGVS, NC, Process Control, etc, etc.)
- Most CIM Components Are People Systems Not Just Computer/Automation Systems
- Process Integration Requires a Game Plan; without It There Can Be No Vision of Steps to Take

WHERE DO I START?

- MRP II?
- JiT/KANBAN?
- NC/CNC/DNC
- CAD/CAM/CAE?
- Robotics?

MRP II BEFORE JiT?

- Successful MRP II Good Springboard for Successful JiT - Controls Stockroom, Purchasing and Shop Floor
- MRP II Not Suitable for Small Lot, Fast Flow Common to JiT Environment
- JiT Means Continually Changing Operational Methods

MRP II AT NISSAN

- Parts Scheduled with Suppliers by Communications Links; Confirmed/Updated/ Changed Every 15'.
- Some Synchro Scheduling, Requiring Truck Loading to Be in Exact Sequence Cars Are Coming down the Assembly Line.
- Master Schedule: 99% on Time, Measured Hourly. Supplier On-time Delivery 99.9%, Manufactured 99.5%. Inventory of Purchased Parts Turned Once a Day.

GROUP TECHNOLOGY

- Grouping of Similar Products, Operations to Maximize Design/Manufacturing Efficiencies
- Data Base of Part Design and Manufacturing Characteristics plus Retrieval Software
- Interface with CAD and Process Planning

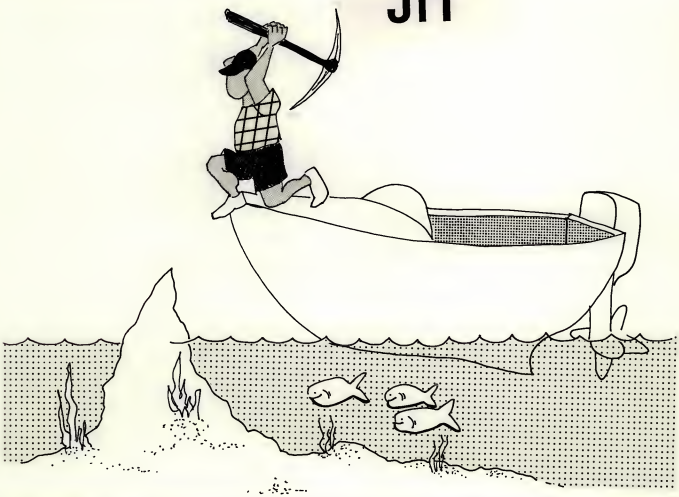
JiT OBJECTIVES

- Increase Manufacturing Responsiveness/ Flexibility
- Lower Manufacturing Costs
- Improve Product Quality
- Give Employees a Sense of Contribution/ Self Worth

JiT APPROACH

- Reduce Inventory to Expose Problems, Solve Them and Lower Inventory again
- Pull-through Production: Sales Driven
- Management/Labor Focus: Collaborative Solutions

JiT



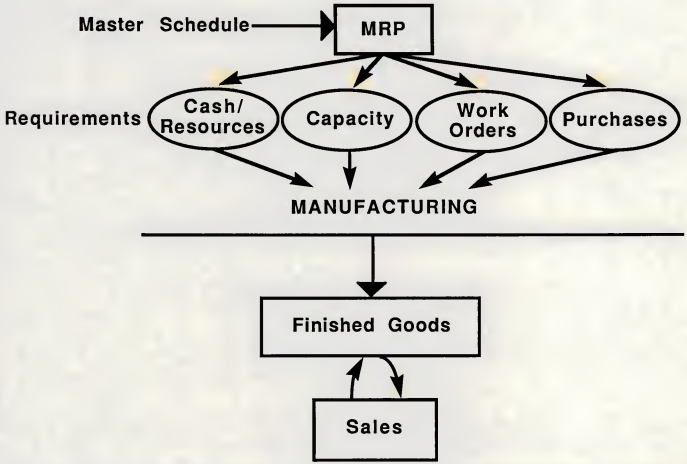
JiT ADVANTAGES

- Increases Manufacturing Cycle Efficiency
- Synchronizes Operations Flow:
  - No Operations Scheduling
  - Little Materials Handling
  - Immediate Quality Feedback
  - Reduced Rework
- Involves Everyone in Problem-solving/ Decision-making

TOYOTA'S JiT SPECIFIC OBJECTIVES

- Reduce Inventory 75%
- Increase Output/Worker 30-40%
- Reduce Defects 90%
- Align Production with Sales

TRADITIONAL ENVIRONMENT



JiT APPLICATION

- Assembly Line/Job Shop
- Kanban Shop Floor Control (Electronic?)
- Pull versus Push
- Slow Process, Area by Area
- Mental Shift, Systems Shift

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STATUS OF CIM
1986

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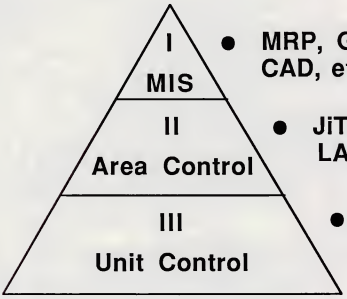
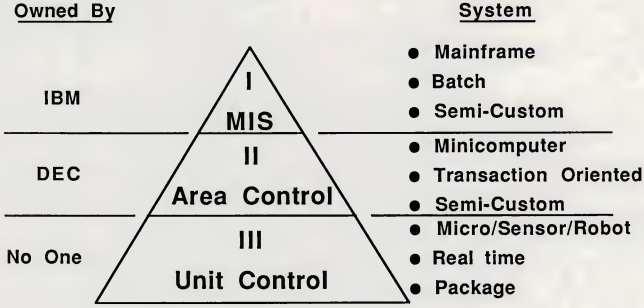
CIM OPERATIONAL LEVELS



- MRP, Group Technology, CAD, etc.
- JiT, Process Control, LAN/Network, DNC. . .
- CNC, Machine Tools, FMS, Robotics. . .

CIM MARKETS



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U.S. MANUFACTURING PLANT AND EQUIPMENT EXPENDITURES

- U.S. Businesses Plan to Spend 2.5% Less in 1986 than in 1985
- Widespread Downward Revisions in Manufacturing Sector Growth
- Removal of Investment Incentives in Pending Tax Bill

CIM'S SLOW PROGRESS

- Rapid Change in Technology; Far Ahead of U.S. Industry's Ability to Implement It
- Management Confused, Ill-prepared to Implement CIM, not Knowledgeable
- Traditional Organizational Resistance to Change
- Even Very Large Corporations Are Implementing CIM at a Slower than Anticipated Pace

EVEN "ISLAND" IMPLEMENTATION IS SLOW

Example

Amana refrigeration's implementation of MRP II will take three years to train engineering, service, manufacturing, purchasing, personnel, accounting and quality control departments in its use.

ROBOTICS

- GM Cancels $80 Million of Orders
- GMF Robotics Reduces Staff to 500 (from 700)
- Machine Vision International Lost $7 Million in First Half 1986
- Slower Development than Forecast

THE HUMAN ELEMENT

- Introducing People to a New System Is a Lengthy Process, Requires Patience - the U.S. Worker Views Technology As an Adversary
- Incremental Changes, Evolution Required, not Sudden Technological Revolution
- Japanese Advantage Is Their Culture and Painstaking Attention to Detail

U.S. VERSUS JAPAN

- Japanese Orientation Is for Process Improvement, Long-term Production Evolution
- U.S. View Has Been, "We're Behind, Technology Can Provide a Quick Fix, Go for It."
- Japanese Approach Tightens the Bond/Blurs the Distinction between Management and Workers; U.S. Approach Widens the Gap

TECHNOLOGY IS MIXED BLESSING

- Technological Change Has Instant But Short-term Impact
- Great Benefits Can Be Obtained, but Systems Are often Complex and Difficult to Use
- Automating a Poor Shop Floor Layout with Inefficient Product Designs and Poor Production Planning Is Not Progress

MISDIRECTED?

- GM's Buick City Has Emphasis on Technology/Hardware ($300M): 30% Reduction in Manufacturing Costs and Substantial Problems
- GM/Toyota Milpitas Plant Has Emphasis on People, Procedures and Production Process Plus Limited/Old Technology: 70% Reduction in Manufacturing Costs and Few Problems

THE RETURN ON INVESTMENT HANG UP

- Larger, Public Companies Generally Screen Investment Decisions for Short-Term Quantifiable Returns (2 to 3 Yr. Payback)

- Traditional Payback Formulae Are Sometimes Difficult to Apply: The Accountant's View Is Likely To Be "I Can't Wholeheartedly Recommend this Investment".

SYSTEMS INTEGRATORS LACKING

- Few Companies Willing/Able to Assume Total Project Responsibility. Exceptions: Arthur Andersen, Systems Control, etc.
- Most Hardware Suppliers Are Not Interested in Being Anything Else = "Limit the Liability".
- Software Vendors Have a Broader View, but Many Won't Even Customize Their Product.

CIM - A PAUSE

- A Lot of Small/Medium-sized Companies Are Not Looking to Change: Daily Routine Is All They Can Handle
- Inceasing Proportion of those Medium/Large Companies Who Have Bought Technology Are Having Trouble Digesting It
- Growing Concern of Those Who Might Have Made CIM Investments That It Might Be "Too Soon"

CIM's CURRENT STATUS

- Some Large/Very Large Corporations Pressing Ahead with Revolutionary, High-stakes Automation/Networking/Integration
- Middle-size Corporations Cautiously Implementing One Aspect at a Time
- Most Small Corporations Doing Very Little

CIM MARKET FORECAST AND SUMMARY

CIM COMPONENTS, 1985-1990

SEGMENT	SALES ($ Billions) 1985	1990
CAD/CAM/CAE	$3.2	$11.1
MRP II	$1.9	$5.1
Process Control	$1.1	$2.3
FMS/FMC	$0.4	$1.8
Robotics	$0.5	$1.3
LAN/Networks	$0.1	$0.7
Totals	$7.2 B	$22.3 B

CIM-INTEGRATION OF ISLANDS OF AUTOMATION

MARKET SEGMENT	PERCENT INTEGRATED
CAD/CAM/CAE	15%
MRP II	12%
Process Control	7%
Robotics	3%
LAN/Networks	80%

CIM SUMMARY

- The Tools Are Secondary to the Process and to the Human Equation
- The Tools Can Wait, the Process Integration Can't
- Automation (e.g. Robotics) Has Well-defined Role
- Waiting for the Perfect Solution Is a Recipe for Losing Market Share

CIM SUMMARY

TEAMWORK. . .

- Problem-solving Culture Beats Automation
- User/Vendors (CIM)
- User/Suppliers (Manufacturing)
- Management/Supervisors/Workers

. . . AND PATIENCE!!