

Nolan-Norton Presentation

July 19, 1990[©]

by

Arthur M. Schneiderman

Presentation date:	Venue:	Notes
July 19, 1990	Nolan-Norton Study Group Meeting	None

Participants in the study, entitled "Measuring Performance in the Organization of the Future," were Advanced Micro-Devices, American Standard, Apple Computer, Bell South, GIGNA, Conner Peripherals, Cray Research, Dupont, EDS, GE, HP, and Shell Canada. Bob and I teamed in a pair of presentations; his, in part, on the HBS Analog Case and mine on the Analog story.

The Executive Summary of the study was published some time in 1991 and included materials from Bob's and my presentations. One display in the Executive Summary was used to demonstrate the linkage between performance measurement and the organization's strategy and vision. It used materials taken from slide 20 in this presentation as an example.

The interest generated by Analog's corporate scorecard prompted a second Nolan-Norton study in which the participants implemented scorecards within their respective organizations. This study provided the basis for the first Kaplan-Norton HBR article, which appeared in the January-February, 1992 issue. Although that article did make brief mention of Analog's use of the half-life method, and described the experiences of an anonymous "NYSE electronics company" (that was us!), it did not describe Analog's pioneering work on the first balanced scorecard. Nor did an article by Larry Maisel, then of KPMG, who was also part of the Nolan-Norton study. He published the study results in the Summer 1992 issue of the Journal of Cost Management in an article entitled "Performance Measurement: The Balanced Scorecard Approach."

This is the slide package I left for the meeting participants. I can't be sure that I used all of these slides in my presentation since I've been unable to locate a copy of the videotape that was made.

Since nearly all of the slides that I used are described in other presentations on this website, I've omitted explanatory notes.

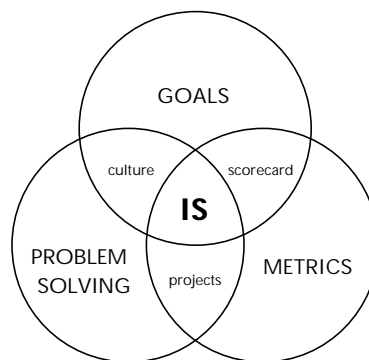
Slide 1

TOTAL QUALITY MANAGEMENT

Art Schneiderman
Analog Devices

* ANALOG DEVICES "at a glance"

* QUALITY IMPROVEMENT PROCESS



Nolan-Norton, July 19, 1990

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6/11/90-06110-5

Analog Devices at a Glance

- Headquartered in Norwood Massachusetts
- Publicly Held (NYSE Symbol ADI)
- \$453 Million in Sales (FY1989)
- 48% of Sales Outside United States
- 5200 Employees Worldwide

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ANALOG DEVICES AT A GLANCE

(cont)

- Products: ICs, assembled products, subsystems
- Applications: precision measurement & control
- Markets: data acquisition
 - 40% industrial/instrumentation
 - 30% military/avionics
 - 13% computer
 - 17% other
- Integrated supplier
 - design
 - manufacturing (8 locations)
 - direct sales (100 locations)

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Slide 4

ADI CORPORATE QIP COUNCIL

MEMBERS:	Jerry Fishman	Executive VP
	Kozo Imai	VP, Japanese Operations
	Larry LaFranchi	Operations Controller
	Bill Manning	Division GM
	Doug Newman	VP, Sales and Marketing
	Art Schneiderman, Chairman	VP, Quality/Productivity Improvement
	Ray Stata	Chairman of the Board and President
	Goodloe Suttler	Division GM
	Suzanne Thomson	Director, Training & Development
	Tom Urwin	VP, European Operations

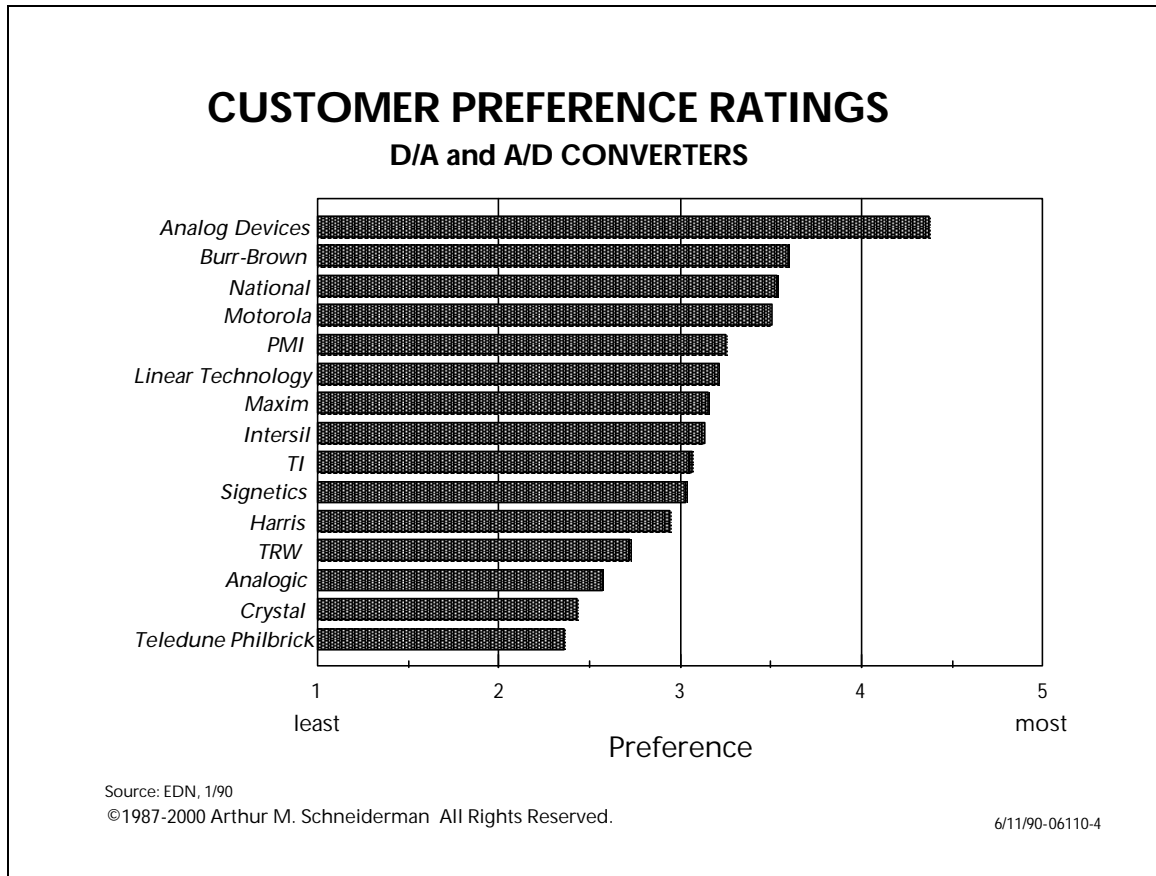
- CHARTER:**
- QIP Organization
 - QIP Goals Deployment → priorities
 - Training → Juran
 - Monitoring → metrics
 - Incenting/Rewarding

1989 Top Customers Worldwide

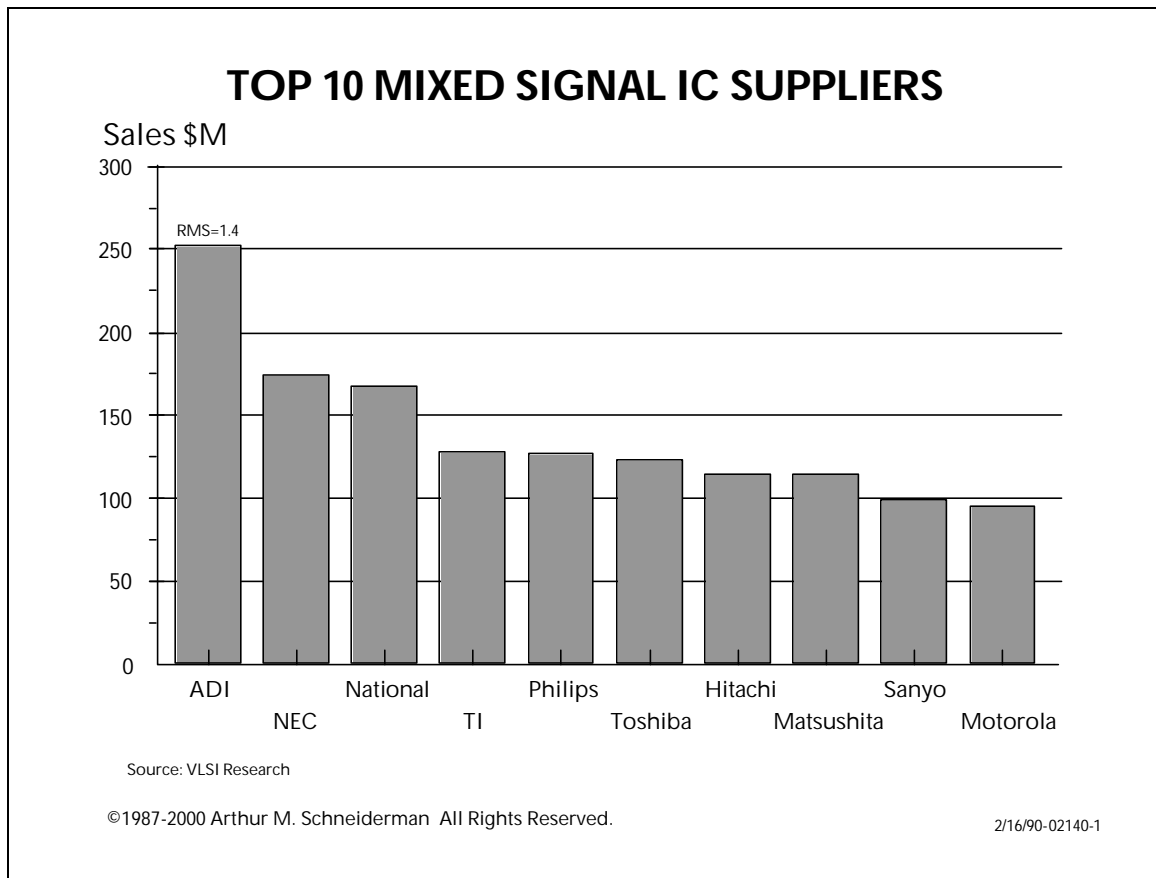
<i>Customer</i>	<i>Bookings</i>	<i>Cumulative</i>
	<i>\$M</i>	<i>%</i>
IBM (US, Japan & France)	26.8	6.0
GE/RCA	10.5	8.3
Fuji (Japan)	10.3	10.6
HP (US, UK & Germany)	9.1	12.6
Honeywell (US, Germany)	7.4	14.2
General Dynamics (US)	5.4	15.5
Raytheon (US)	5.1	16.6
Siemens (US, Germany)	5.1	17.7
TI (US)	4.1	18.6
Mitsubishi (Japan)	4.0	19.5
Fujitsu (Japan)	4.0	20.4
Toshiba (Japan)	3.7	21.1
Marconi (US, UK)	3.6	22.0
Hughes (US)	3.4	22.8
Rockwell (US)	3.3	23.5
Hitachi (Japan)	3.3	24.3
Westinghouse (US)	3.1	25.0
Philips (US, Europe)	3.1	25.6
Motorola (US)	3.0	26.3
DCASR (US)	2.7	26.9

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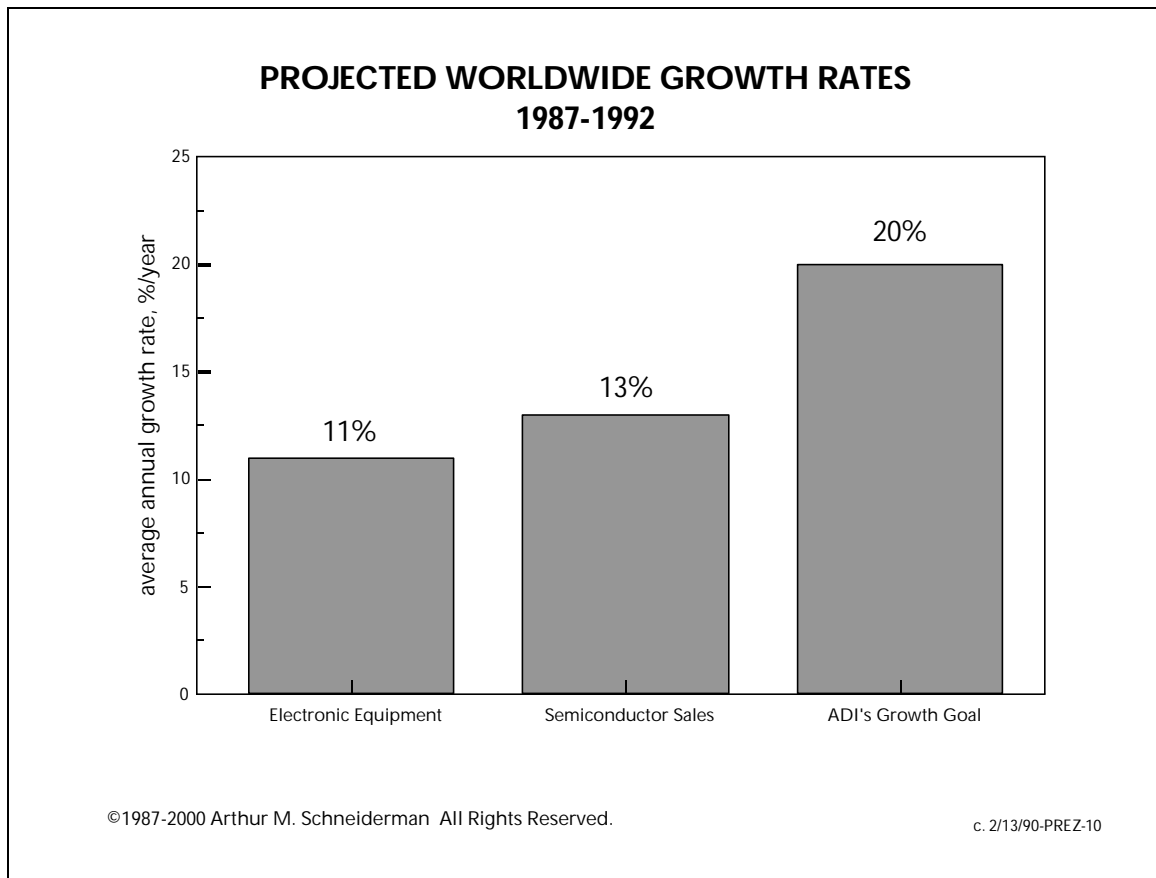
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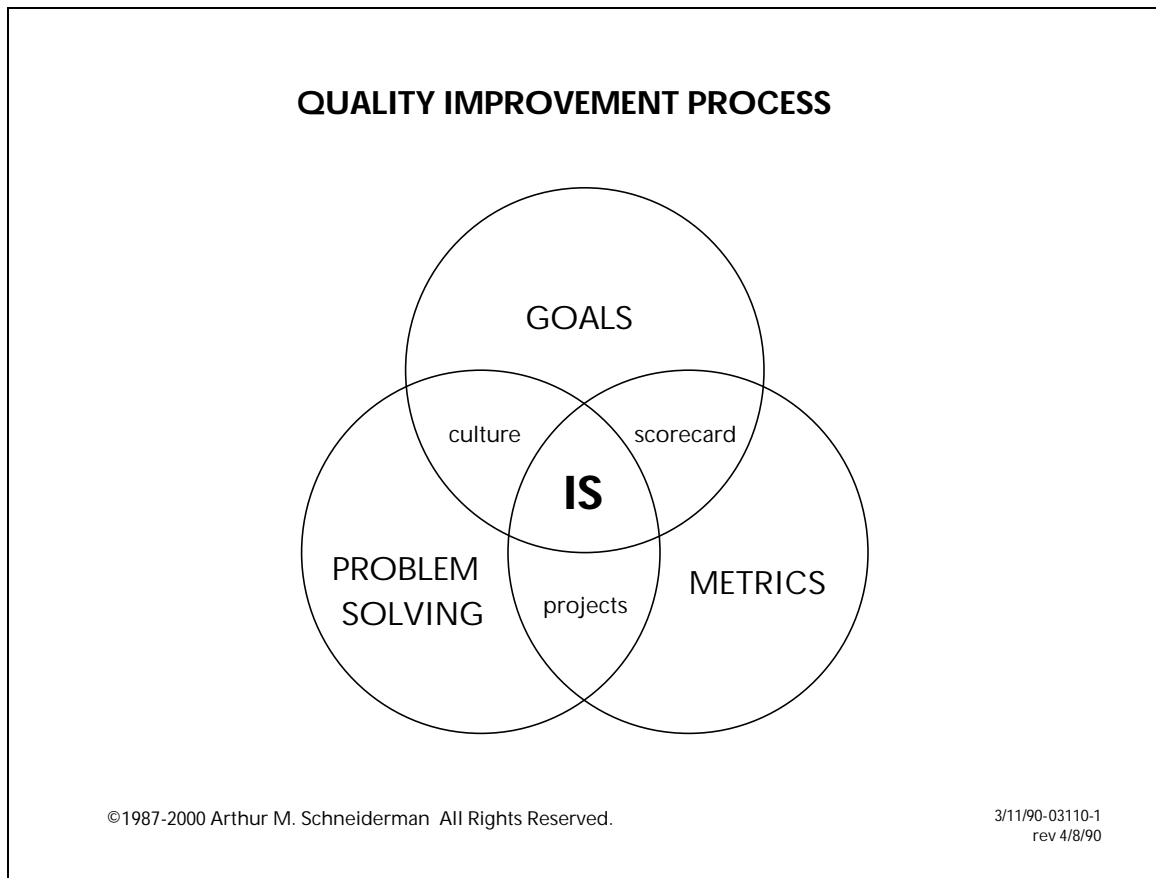


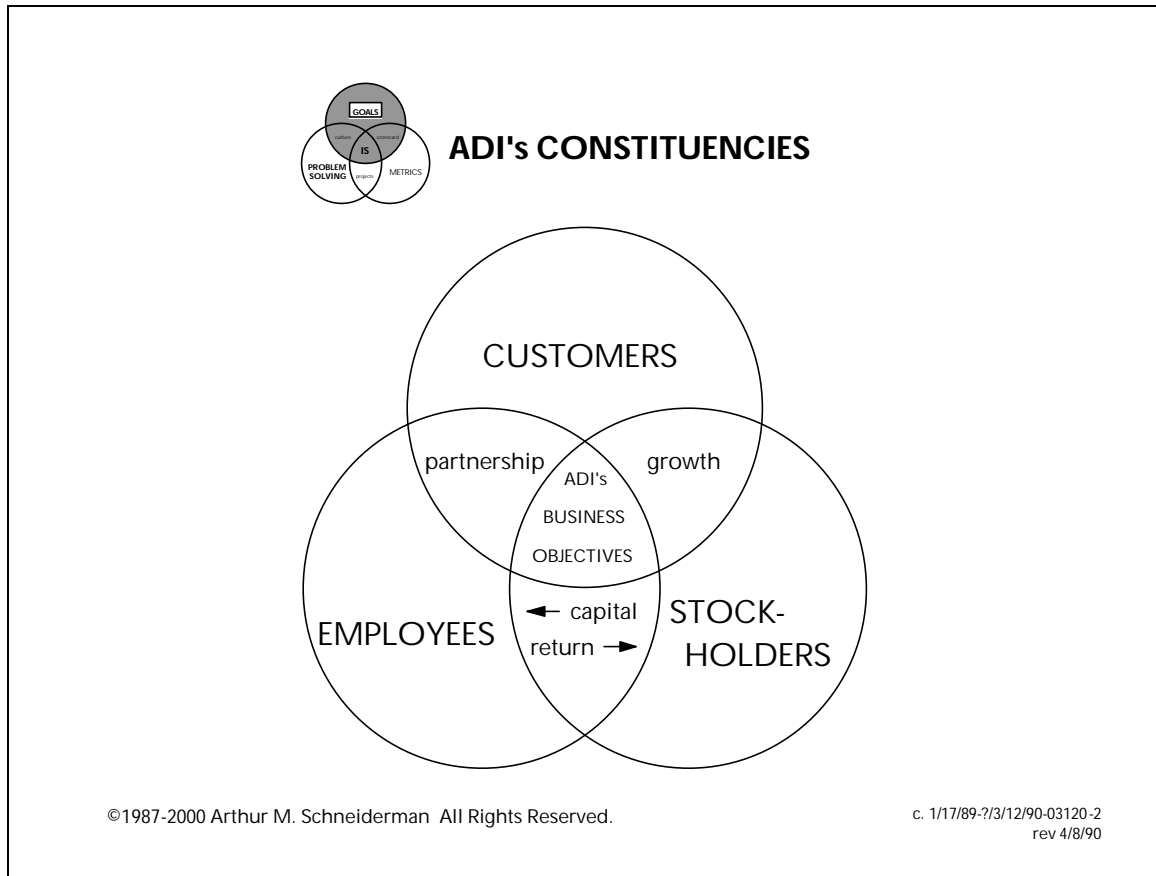
Slide 7



Slide 8







Slide 11



ADI QIP GOALS

BUSINESS

OBJECTIVES:

- MARKET LEADERSHIP (RMS)
- REVENUE GROWTH
- PROFITABILITY

DRIVERS:

- BE RATED #1 BY OUR CUSTOMERS
IN **TOTAL VALUE DELIVERED**

EXTERNAL LEVERS:

- PRODUCTS
- DEFECT LEVELS
- ON-TIME DELIVERY
- LEADTIME
- PRICE
- RESPONSIVENESS

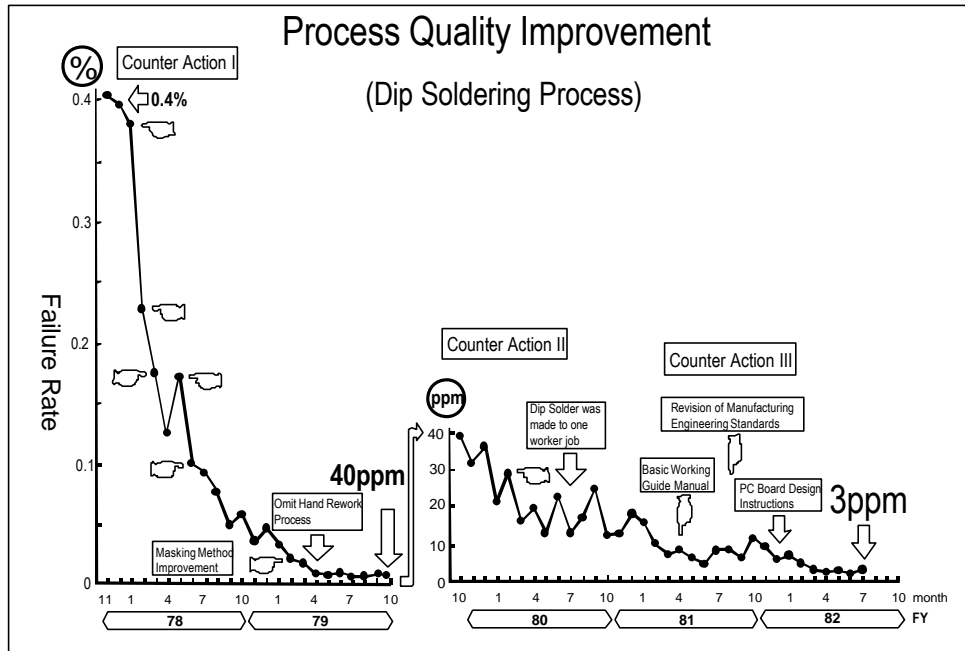
INTERNAL LEVERS:

- TIME TO MARKET
- PROCESS PPM
- MANUFACTURING CYCLE TIME
- YIELD

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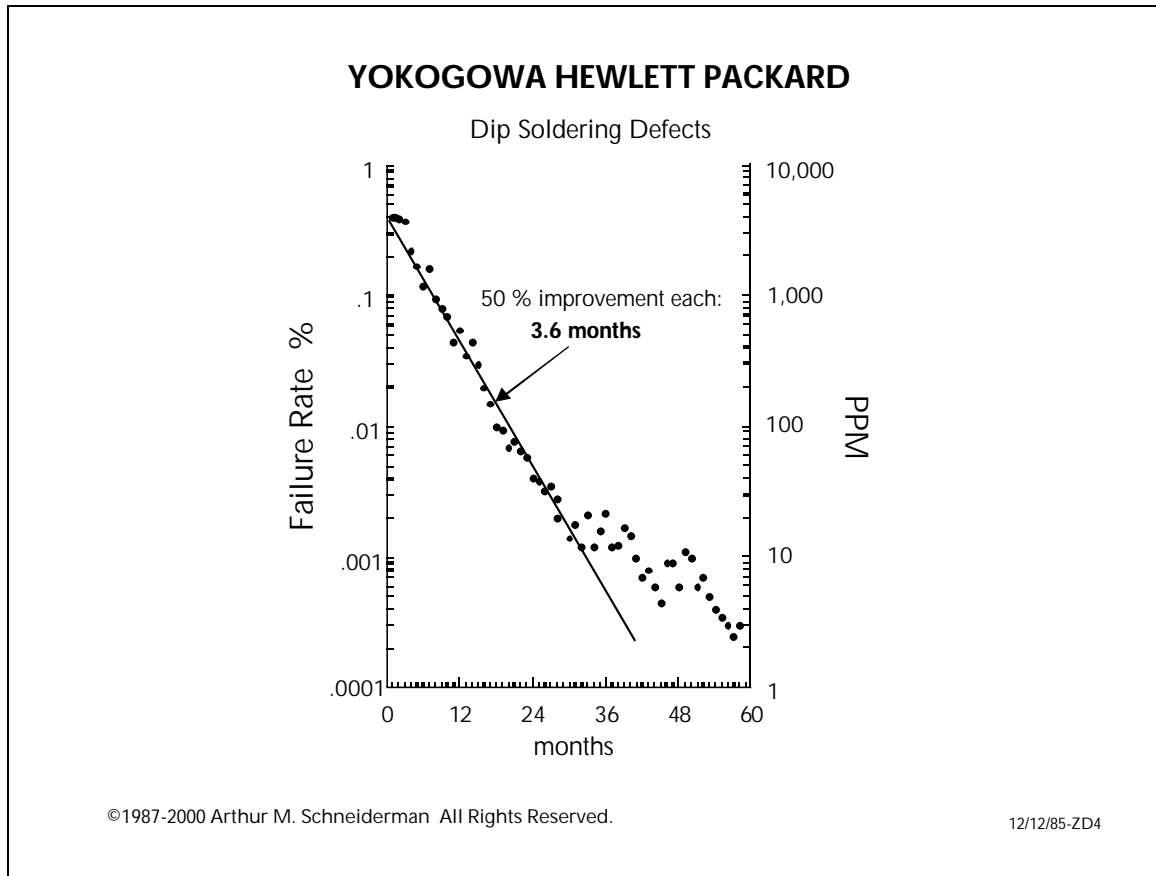
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rev. 4/8/90-04080-2

Slide 12



Source: Kenzo Sasaoka, President
Yokagowa-Hewlett-Packard 7/84

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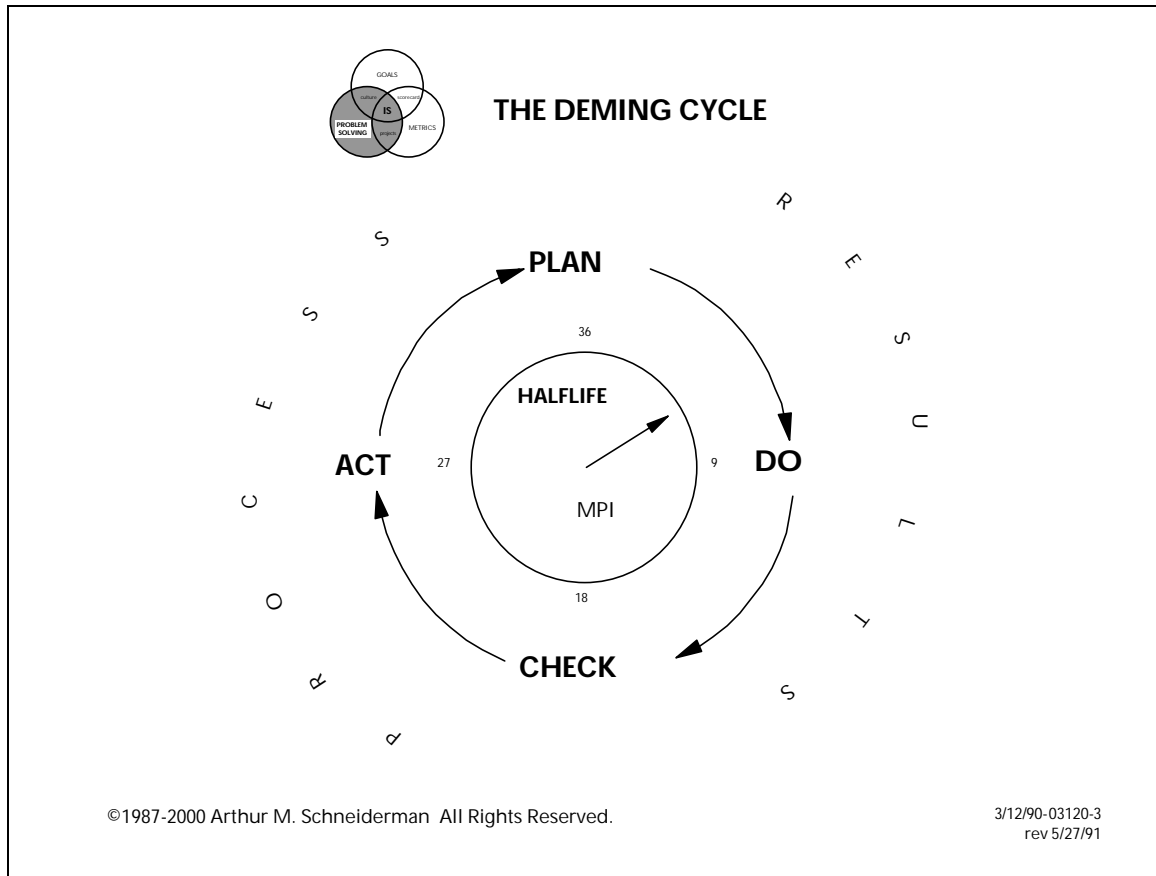
PROPOSED HALF-LIFE MODEL VALUES

<i>PROJECT TYPE</i>	<i>EXAMPLES</i>	MONTHS	
		<i>MODEL HALF-LIFE</i>	<i>EXPECTED RANGE</i>
<i>uni-functional</i>	operator errors WIP	3	0 to 6
<i>cross-functional</i>	new product cycle time outgoing PPM	9	6 to 12
<i>multi-entity</i>	vendor quality warranty costs	18	12 to 24

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Organizational Complexity	<i>hi</i>	14	18	22
	<i>med</i>	7	9	11
	<i>low</i>	1	3	5
		<i>low</i>	<i>med</i>	<i>hi</i>



ADI RESPONSE TO HALF-LIFE CONCEPT

Supporters

Embodies the concept of KAIZEN

Easy to understand

Makes sense

Data not negotiation based ⇔ realistic

Accepted by line organization

Works

focuses on results not process

Critics

Doesn't reflect where we need to be

Hard to understand

Hard to use

manual vs. computerized

assumes instant startup

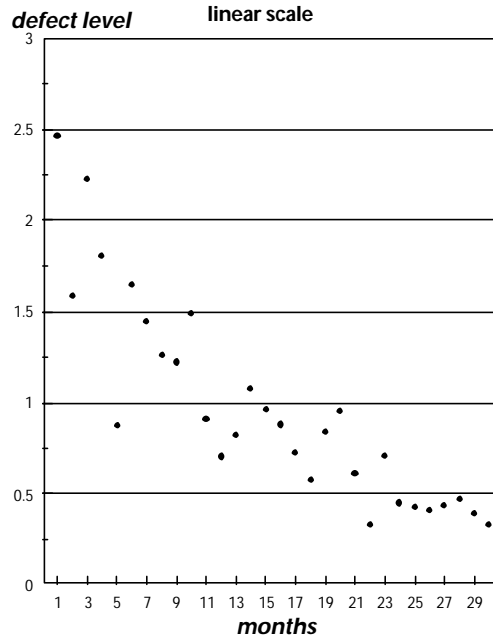
assumes constant rate of learning

focuses on results not process

**"...the rate at which individuals and organizations learn
may become the only sustainable competitive advantage..."**

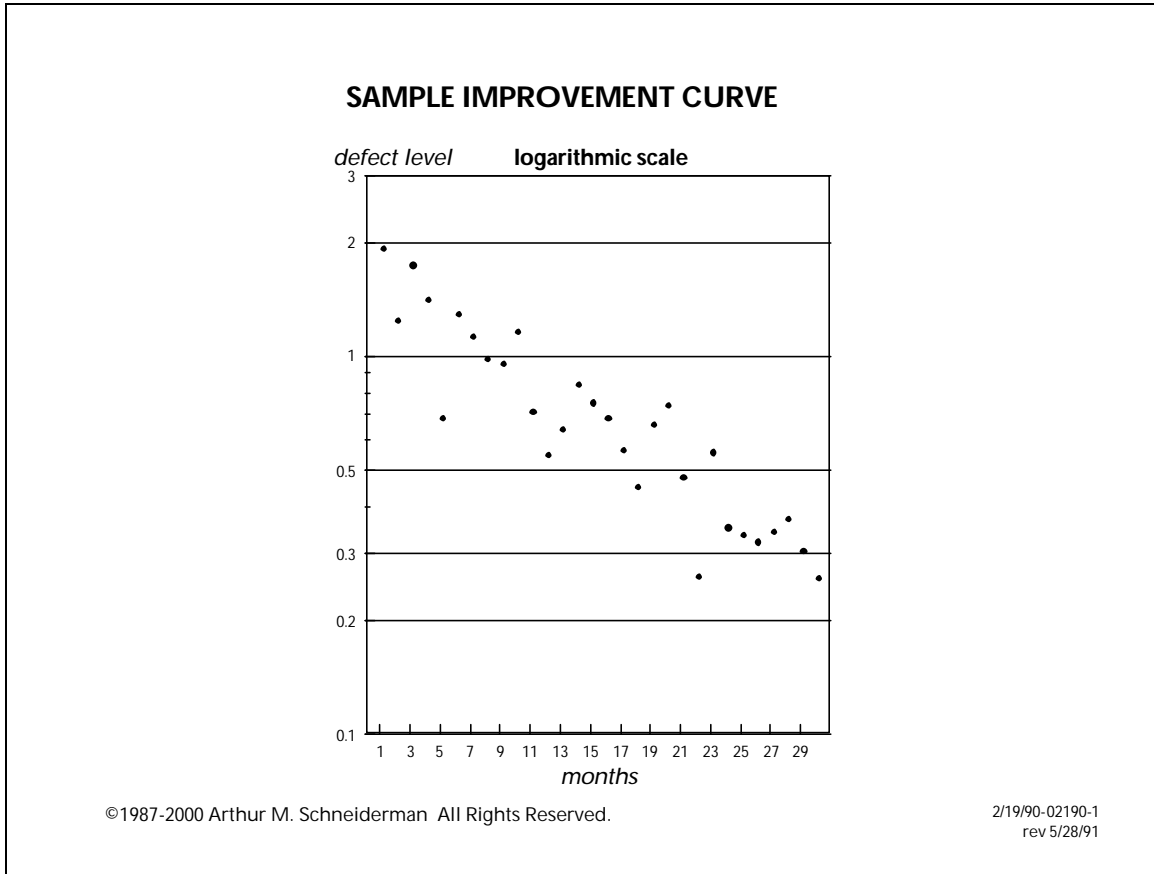
Ray Stata

SAMPLE IMPROVEMENT CURVE



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ADI QIP GOALS			
IC OPERATIONS, ESTABLISHED PRODUCTS			
METRIC	1987	HALF-LIFE	1992
EXTERNAL			
On time delivery	85%	9	>99.8%
Outgoing defect levels	500 PPM	9	<10 PPM
Lead time	10 wks	9	<3 wks
INTERNAL			
Manufacturing Cycle Time	15 wks	9	4-5wks
Process Defect Levels	5000 PPM	6	<10 PPM
Yield	20%	9	>50%
Time to Market	36 mths	24	6 mths

WHILE AGGRESSIVELY PURSUING
CORPORATE-WIDE COST MANAGEMENT

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rev. 7/25/87

Slide 21

FY1990 CORPORATE SCORECARD											
FINANCIAL	End FY89	Q1 90		Q2 90		Q3 90		Q4 90		FY 90	
	ACTUAL	BHMK	ACTUAL	BHMK	ACTUAL	BHMK	ACTUAL	BHMK	ACTUAL	BHMK	ACTUAL
SALES											
SALES GROWTH YTY											
CONTRIBUTION MARGIN											
ROA (CM)											
<i>QIP</i>											
ON TIME DELIVERY (To FCD)											
% CRDs NOT MATCHED											
EXCESS LEADTIME											
LABOR TURNOVER											
<i>MANUFACTURING METRICS: IC PRODUCTS</i>											
OUTGOING PPM											
PROCESS PPM											
CYCLE TIME											
YIELD											
<i>MANUFACTURING METRICS: ASSEMBLED PRODUCTS</i>											
OUTGOING PPM											
PLUG-IN YIELD											
CYCLE TIME											
% COST OF SCRAP/REWORK											
<i>NEW PRODUCTS</i>											
BOOKINGS POST-85 PROD	ACTUAL	FY87 PLAN	ACTUAL	FY87 PLAN	ACTUAL	FY87 PLAN	ACTUAL	FY87 PLAN	ACTUAL	FY87 PLAN	ACTUAL
FORECAST 3 rd YR BOOKINGS of new product releases	FY89	1Q90	2Q90	3Q90	4Q90	FY90					

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c. 1989-Scorecard

?

1990 Scorecard

ADI

Qtr 2 1990

1
2

Line Item		Actual	Budget	Variance	% Var.
QIP:					
On Time Delivery % (To FCD)	%	96.10	97	-1.00	-1 #
CRDs Not Matched	%	52.10	41	10.70	26 #
Excess Leadtime	WKS	2.80	3	-.10	-3
Employee Turnover	%	8.40	19	-10.70	-56
IC Outgoing PPM		1210.00	908	302.00	33 #
IC Process PPM		1624.00	1516	108.00	7 #
IC Cycle Time	DYS	50.10	62	-12.30	-20
IC Yield	%	40.40	38	2.80	7
AP Outgoing PPM		1483	1977	-494.00	-25
Plug In Yield	%	91.40	91	.50	1
AP Cycle Time	DYS	21.90	29	-6.70	-23
Scrap/Rework Cost	%	7.70	14	-6.40	-45

Retrace

Utilities

1989 Scorecard

Commentary

Return

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?

1990 Scorecard

ADI

Qtr 2 1990

1
2

Line Item		Actual	Budget	Variance	% Var.
NEW PRODUCTS:					
Post 1985 Products	\$M	40.30	42	-1.60	-4 #
Forecasted 3 rd Year Bookings	\$M	9.90			
FINANCIALS:					
Sales	\$M	116.40	117	-.30	-0 #
Sales Growth (YTY)	%	1.20	2	-.30	-20 #
Contribution Margin	%	6.30	8	-2.00	-24 #
ROA (Contribution Margin)	%	7.50	10	-2.00	-21 #

Retrace

Utilities

1989 Scorecard

Commentary

Return

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1Q90-Scorecard-2



**If you don't measure it,
it will not improve.**

does not mean

measurement  improvement



GOAL:
IMPROVE CUSTOMER SERVICE

CUSTOMER SERVICE METRICS

ON TIME

% late  % on time
% early

RESPONSIBILITY

factory credit
warehouse customer

LATENESS/EARLINESS

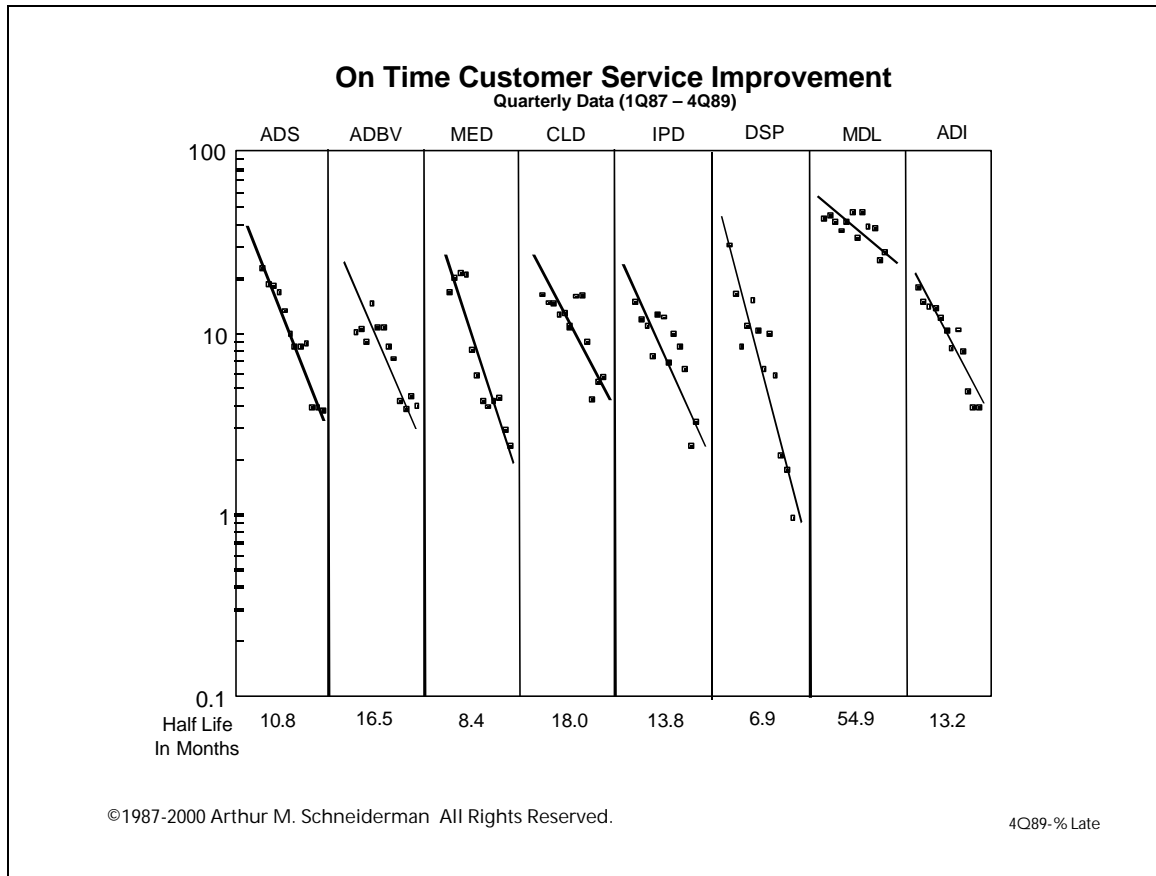
shipped late, how late?
shipped early, how early?
still late, how late?
months to ship late backlog

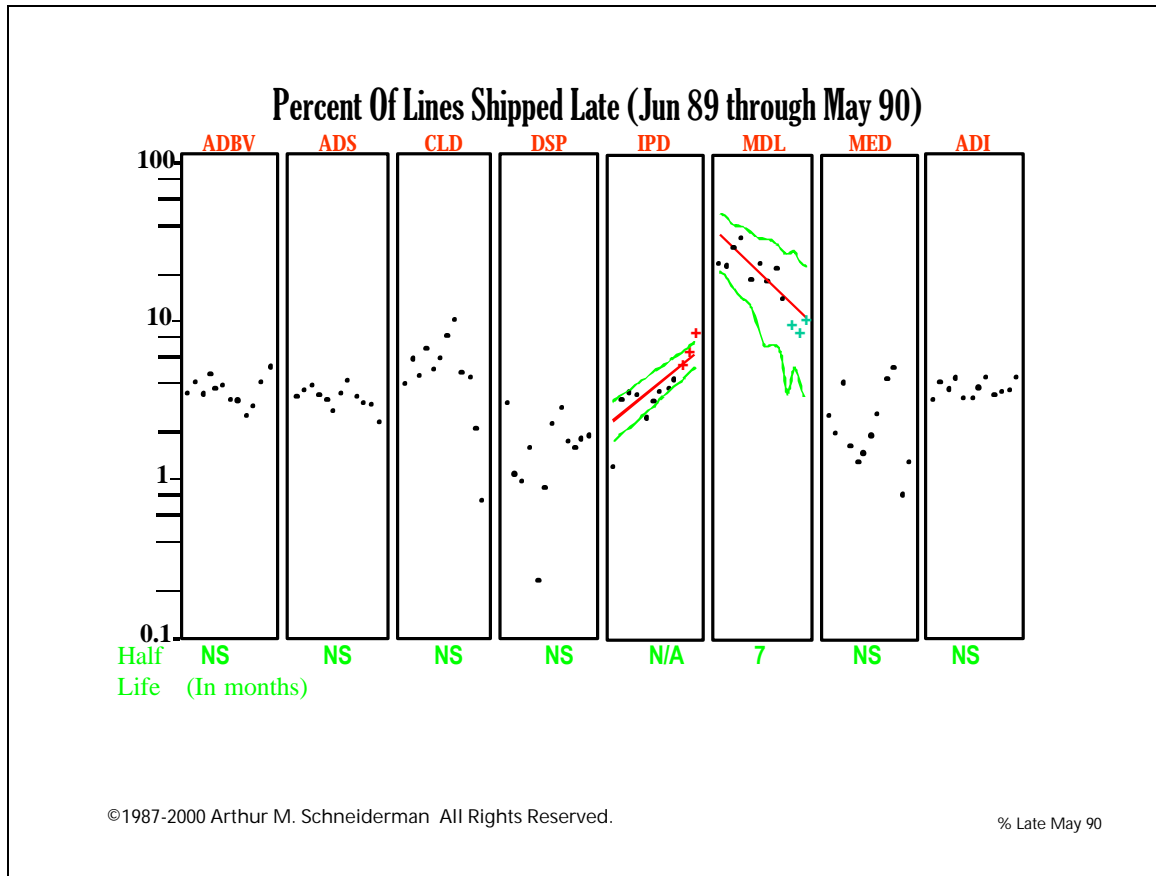
LEAD TIME

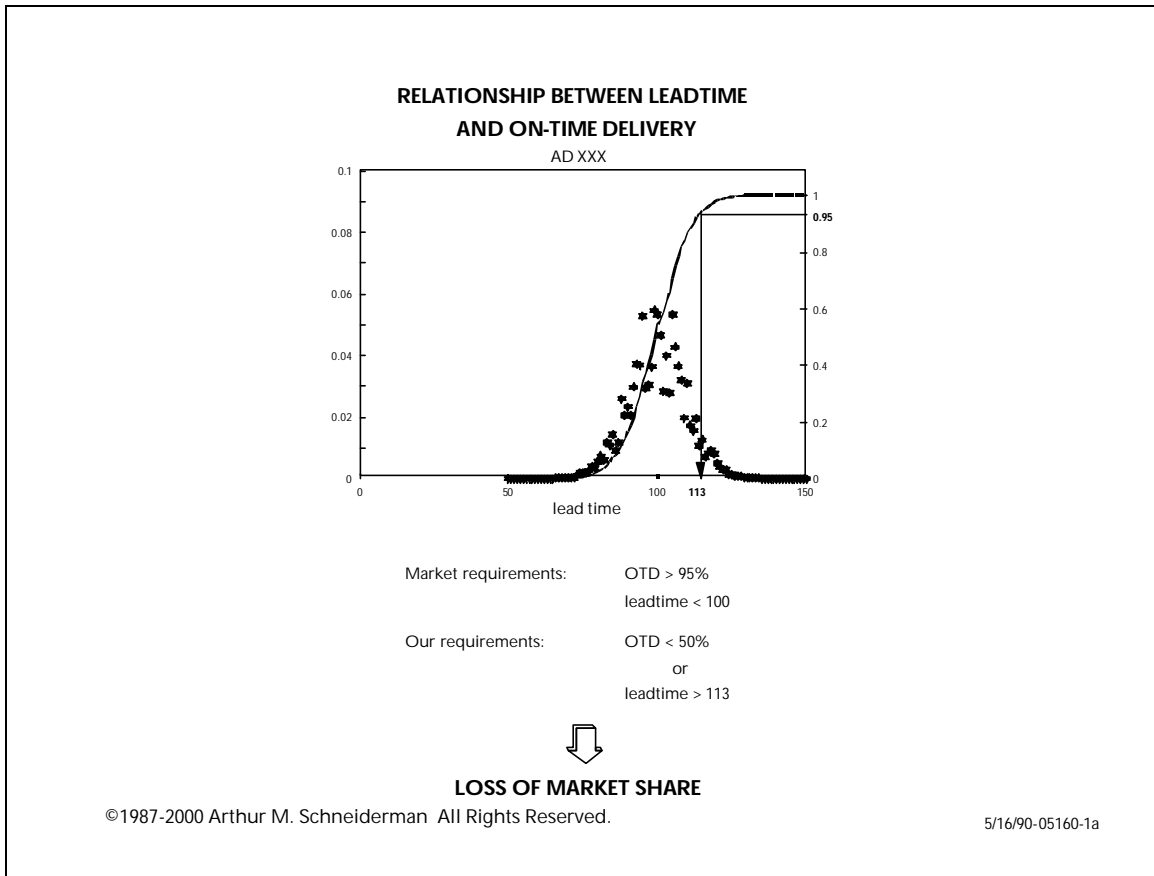
customer requested lead time
% CRD's matched
excess lead time

RESPONSIVENESS

time to schedule an order





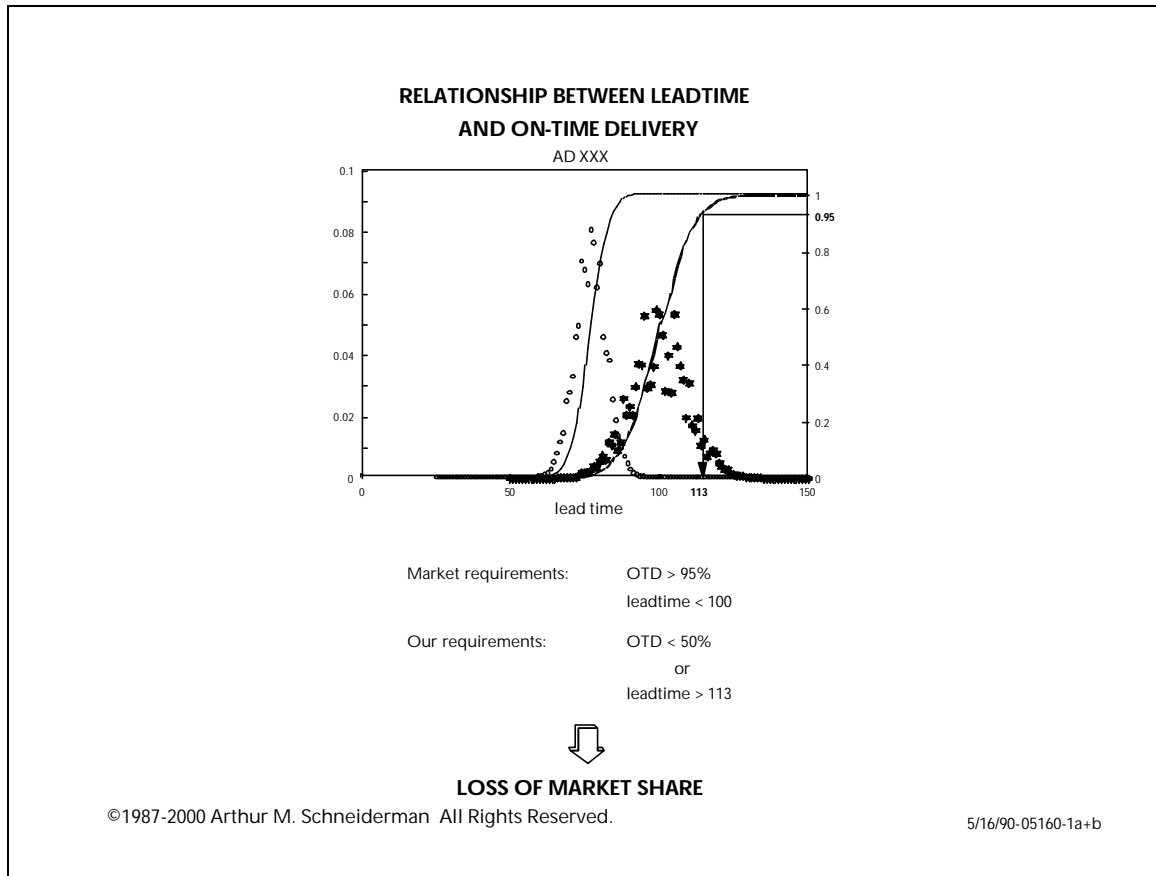


IMPROVING ON THE OTD/LEADTIME TRADEOFF

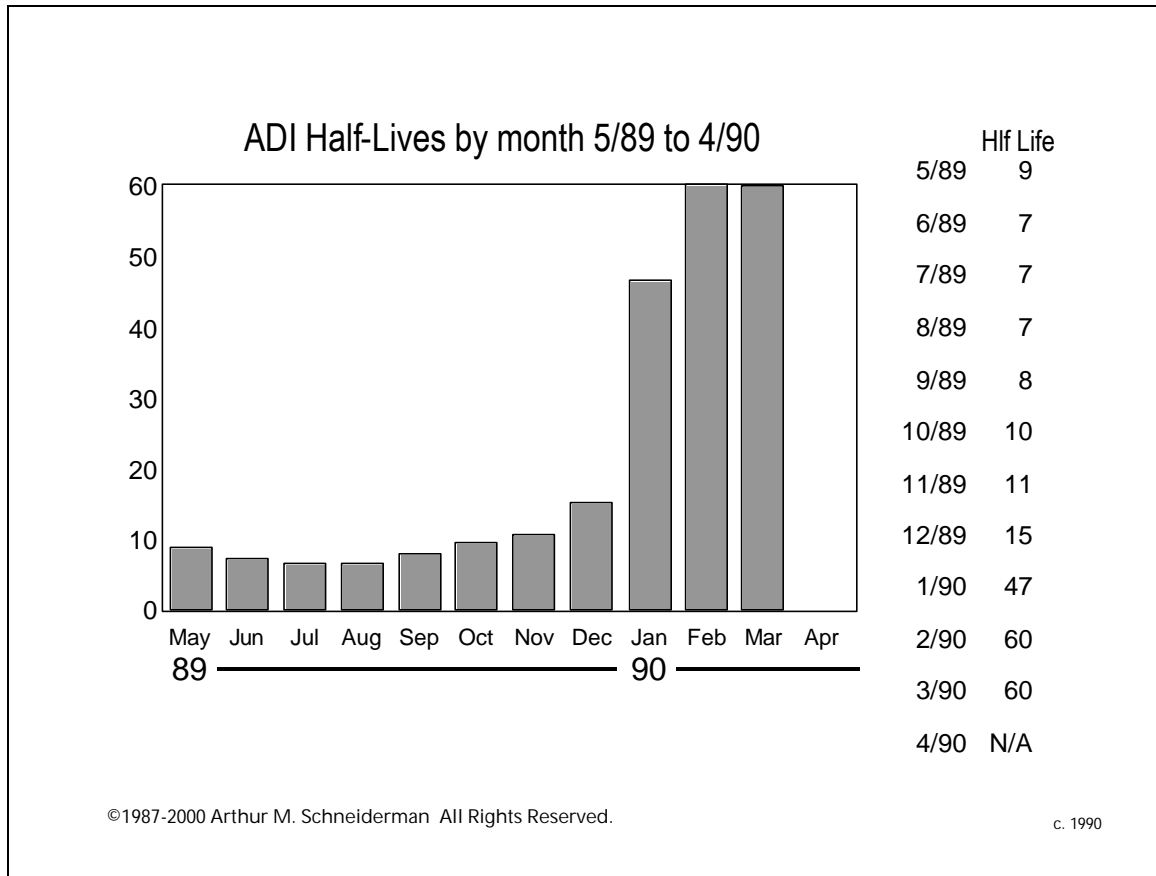
1. increase inventory
2. build to good forecasts
3. reduce manufacturing cycle time

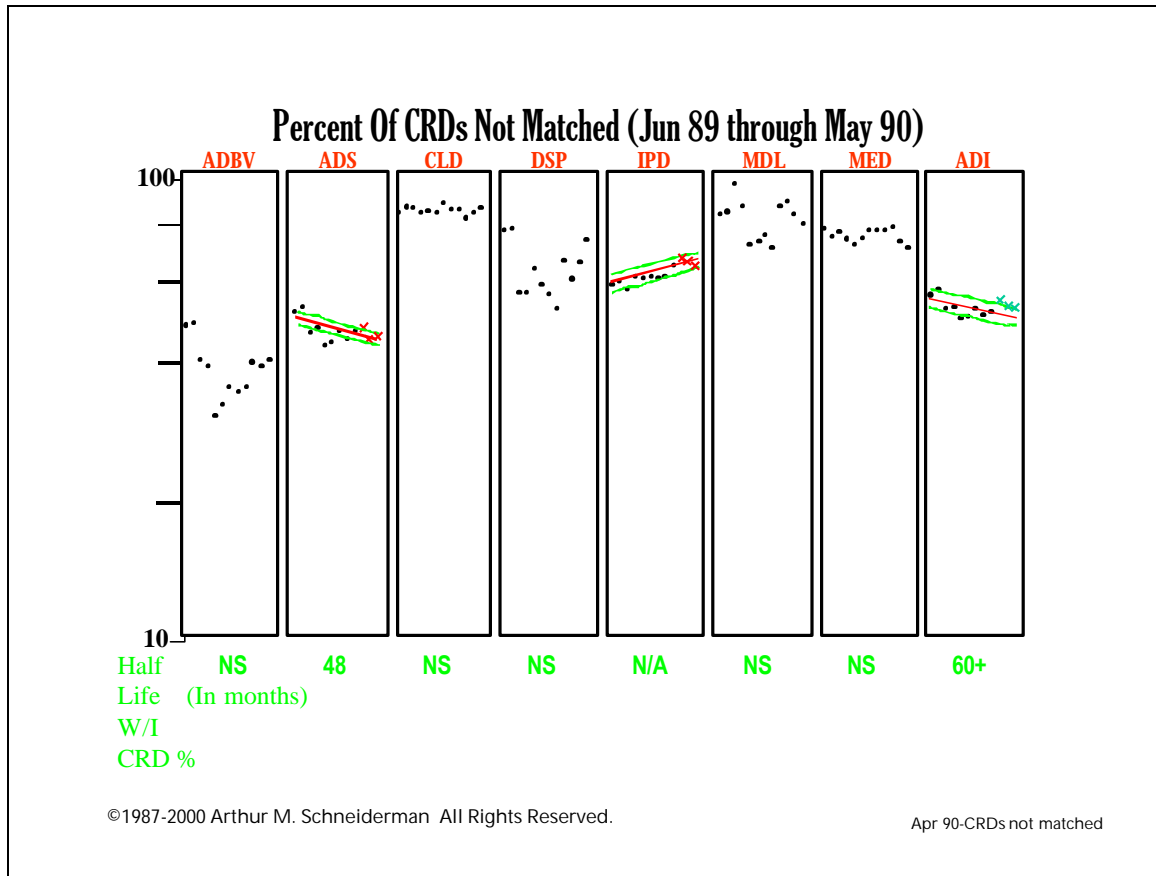
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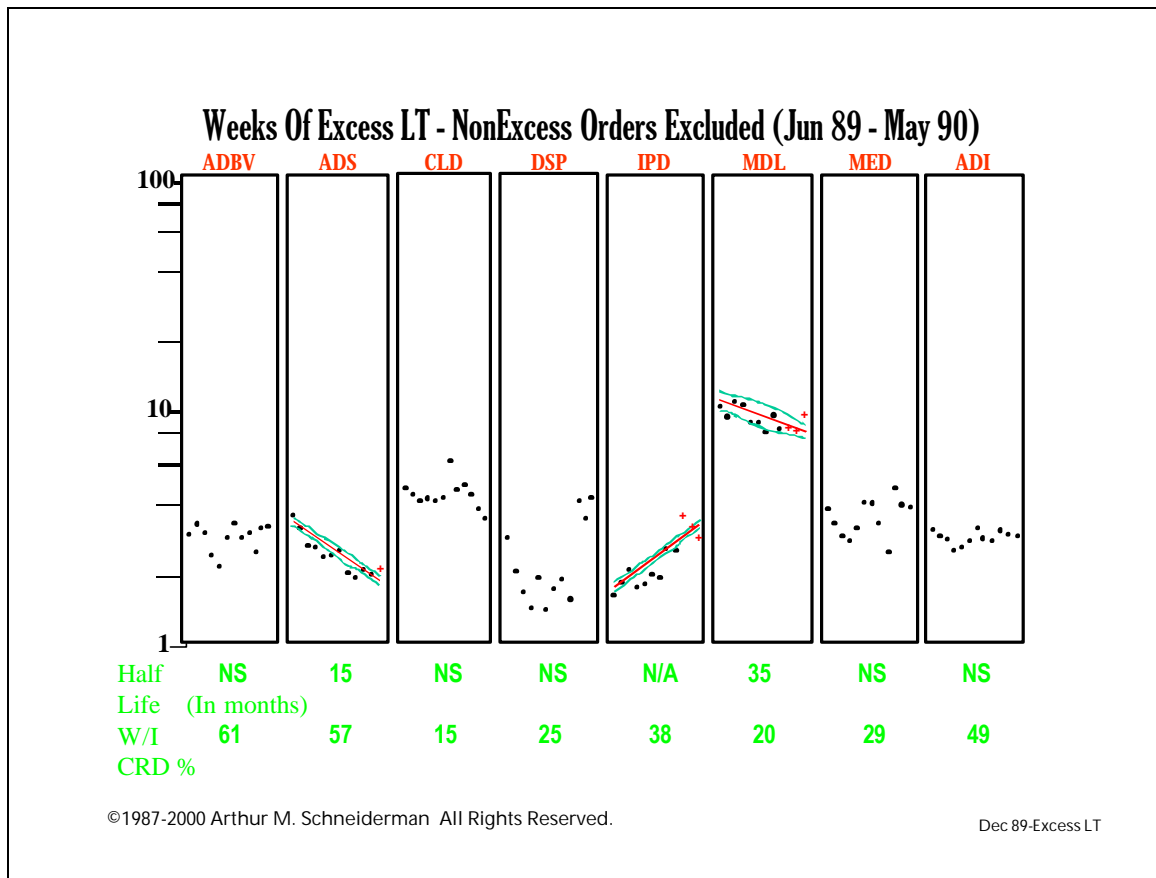


Slide 31



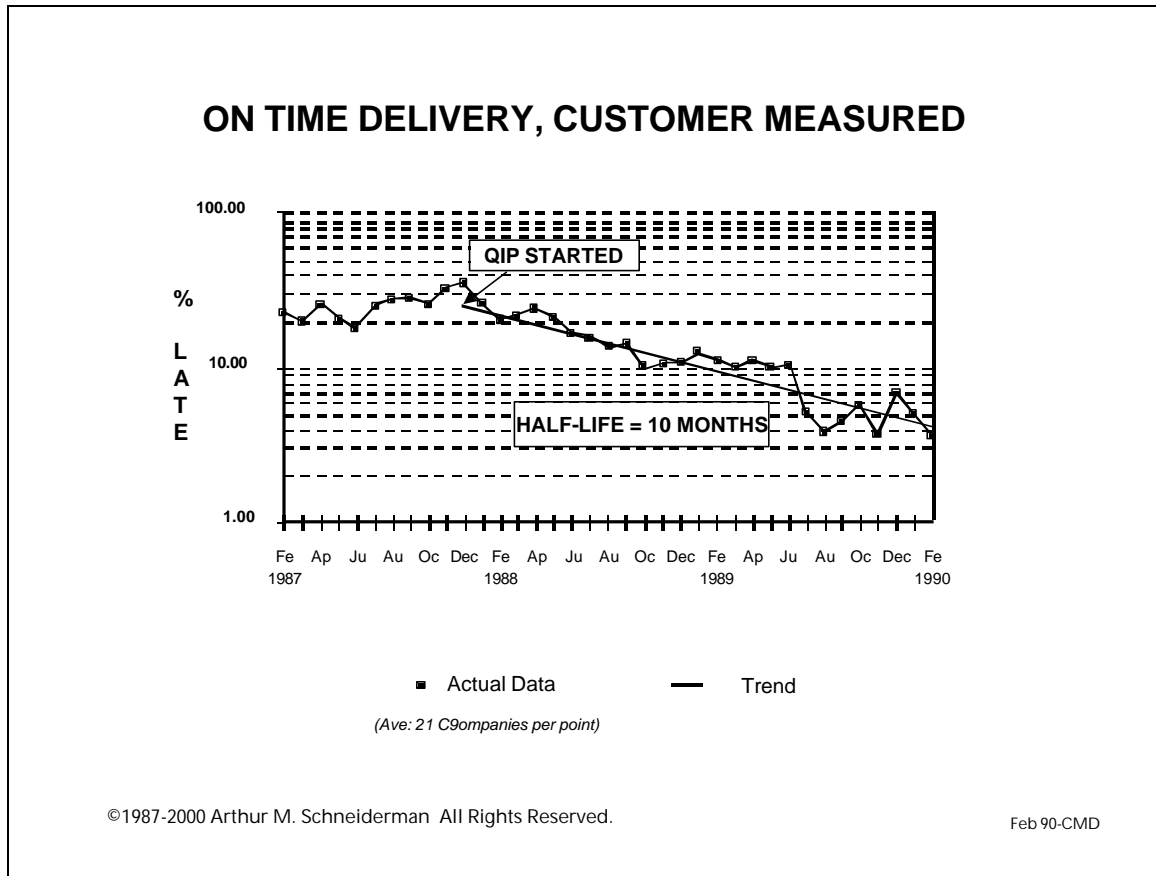


Slide 33



48 CUSTOMERS IN VENDOR RATING DATABASE

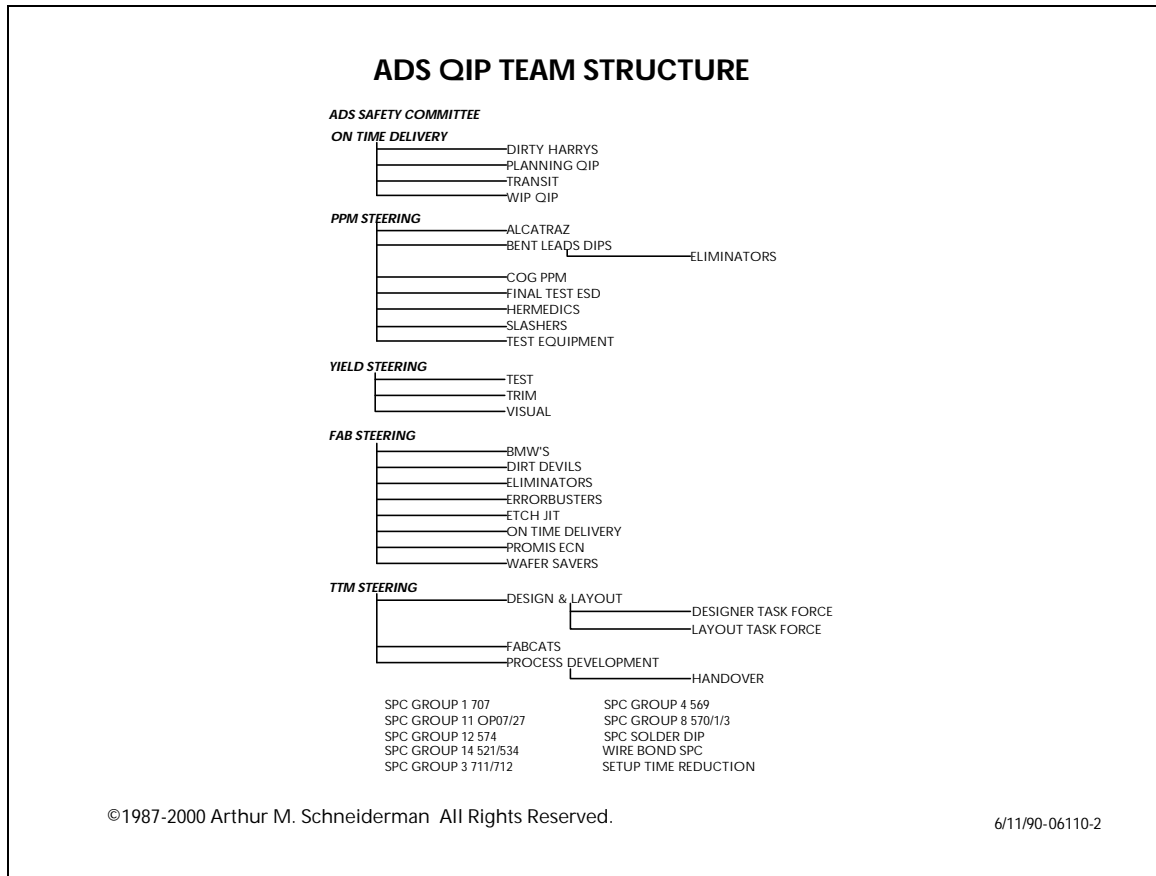
ABB	M/A-COM
AGFA	Martin Marietta
Allen Bradley	Marquette Electric
Allied Signal	Masscomp
Ametek	Microcircuits Semiconductor
Apollo	McDonald Douglas
AT&T	Parker Air & Space
Brown Engineering	Penastar
Compugraphic	Perkin Elmer
Currie-Peak-Frazi	Raytheon
Eaton	Reliance Electric
Finnegan	Rockwell
Ford	Sanders
General Electric	Siemens
GEC	Sikorsky
Gould	Tektronix
Hewlett-Packard	Teleco
Honeywell	Teledyne
Hughes	Teradyne
Instron	Texas Instruments
JET Electronics	Trillium
Kodak	United Technologies
Loral	Waters Associates
Lucas	Westinghouse



HEWLETT-PACKARD VENDOR RATINGS

<i>year</i>	<i>ADI rank</i>	<i>total suppliers</i>	<i>category</i>
1986	8	16	linear IC suppliers
1987	5	8	linear IC suppliers
1988	5	15	all IC suppliers
1989	1 [*]	12	all IC suppliers

* tied with one other supplier

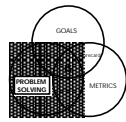


TYPICAL QIP PROJECTS

NAME	MEMBERS	PROJECT	METRIC
<i>BMW'S</i>	8 FAB LINE OPERATORS 2 FAB TECHNICIANS 2 FAB ENGINEERS 3 FAB SUPERVISORS	REDUCE THE QUANTITY OF BROKEN/MISSING WAFERS PER MILLION MOVES	YIELD
<i>ERRORBUSTERS</i>	6 FAB LINE OPERATORS 3 FAB TECHNICIANS 1 FAB ENGINEER 1 FAB MANAGER	REDUCE MISPROCESSING IN PHOTO	YIELD
<i>DIRT DEVILS</i>	2 FAB LINE OPERATORS 2 YIELD ENHANCEMENT 1 FAB SUPERVISOR 1 Q.C. INSPECTOR 1 FAB TECHNICIAN 1 EQUIPMENT REPAIR	REDUCE PARTICLE COUNT IN FAB	YIELD
<i>PLANNING QIP</i>	2 BUSINESS PLANNING 2 MANUF. SUPERVISORS 5 P.C. PLANNING 1 FINANCE 1 PURCHASING 1 CUSTOMER SERVICE	INCREASE CUSTOMER SERVICE WHILE REDUCING CYCLE TIME AND MINIMIZING INVENTORIES	ON TIME DELIVERY
<i>ALCATRAZ</i>	5 TEST OPERATORS 2 BRAND OPERATORS 1 Q.A. ENGINEER 1 BRAND SUPERVISOR	ELIMINATE FACTORY ESCAPES	PPM
<i>FABCATS</i>	1 C.A.S. OPERATOR 1 MASK FAB MANAGER 1 Q.C. MANAGER 1 FAB MANAGER 1 P.C. PLANNING 2 P/L COORDINATORS 1 FAB COORDINATOR	MINIMIZE TAT ON NEW PRODUCT DEVELOPMENT LOTS	TIME TO MARKET

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PROBLEM SOLVING

Participants:

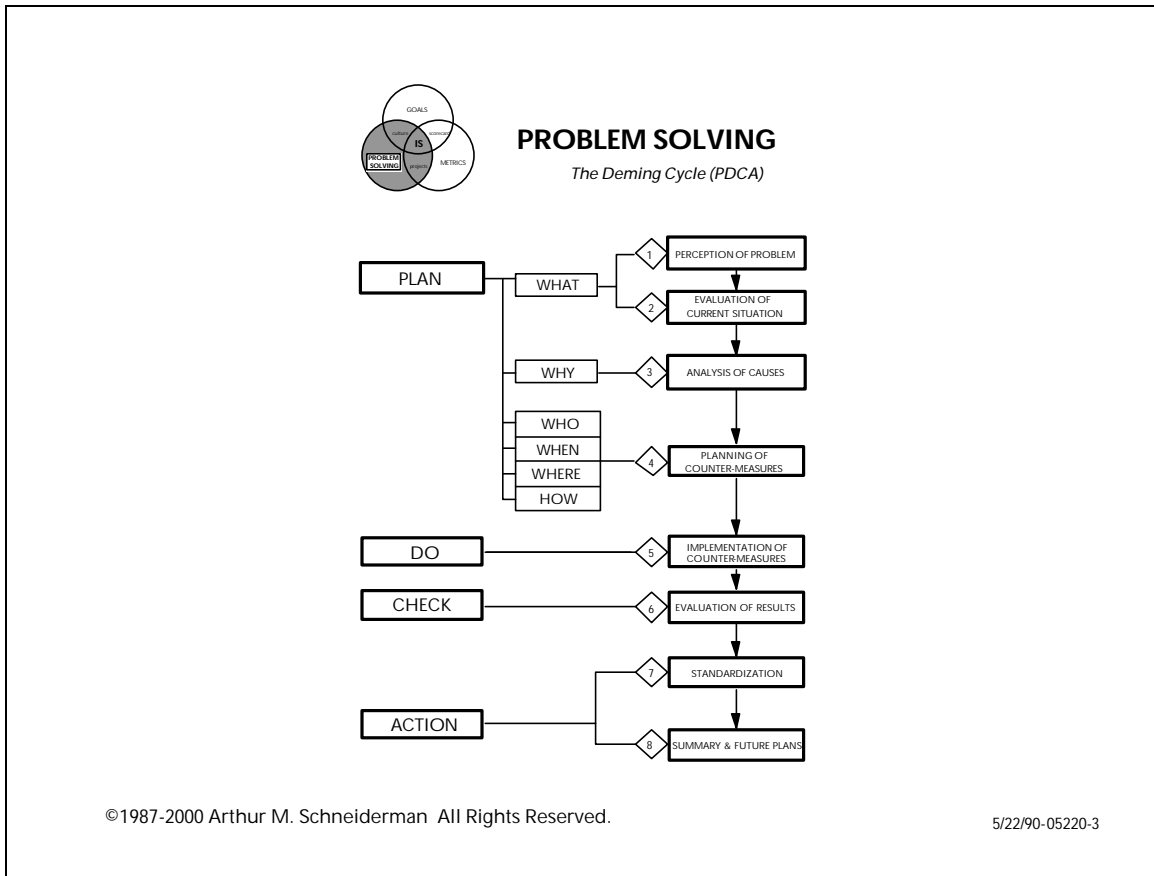
- Cross Functional Problem Solving Teams (QIP Teams)
- Task Forces
- QC Circles
- Individuals

Systematic Approach:

- Deming Cycle (PDCA)

Tools:

- 7 QC Tools (fishbone, histogram, ...)
- 7 Management Tools (KJ Method, affinity diagram,...)
- Design of Experiments (Taguchi, etc.)
- SQC (control charts)
- SPC (Cp, Cpk)
- Quality Cost (failure, prevention, appraisal)
- QFD
- Hoshin Kanri
- SMED
- TPM
- EI
- JIT/Kanban (cycle time, WIP reduction)



**CENTRAL PRINCIPLES OBSERVED
IN TQM IMPLEMENTATION**



- Primacy of the Customer
 - customer first
 - customer satisfaction
 - market-in
- Use of the PDCA cycle for continuous improvement
- Strong CEO and top management leadership
 - policy deployment
- Education and training for all
- Respect for all people
 - teamwork
 - participative management

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THE QIP CULTURE

- We each have a dual function
daily job  SDCA cycle
process improvement  PDCA cycle
- We are committed to improving customer satisfaction
- We are dedicated to (kaizen) continuous improvement
- We are part of a parallel organization: functional and cross-functional
- We are a continuously learning organization

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rev 7/9/90

REQUIREMENTS FOR QUALITY IMPROVEMENT		
<i>Top Management Commitment</i>	<i>Sense of Urgency</i>	<i>Systematic Method</i>
leadership changed objectives hands-on management visibility support	profit opportunity competition fuel for change	proven results kaizen data driven cross-functional
<i>Pilot Projects</i>	<i>Company Wide Involvement</i>	<i>Organization/ Systems</i>
overcome skepticism build credibility get ball rolling develop champions	weakest link internal customers policy deployment vendors/customers	training guiding : monitoring rewarding :
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