SDPROCESS 2004 CANADA

[Session P1]
CMM BASED PROCESS IMPROVEMENT AND AUTOMATION - A CASE STUDY

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SDPROCESS 2004 CANADA

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CMM based Process Improvement and Automation

A Case Study

Improving *productivity, quality and controls*

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Capability Maturity Model

Continuously improving Process
3 KPAs

Level 5 - Optimizing (316)
- Process Change Management (19)
- Technology Change Mgt (19)
- Defect Prevention (18)

Process Improvement Institutionalized

Predictable Process
2 KPAs

Level 4 - Managed (260)
- Software Quality Management (13)
- Quantitative Process Mgt (18)

Sept 2000

Products & Processes Quantitatively Controlled

Standard, consistent Process
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Level 3 -Defined (229)
- Peer Reviews (9)
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- Organization Process Focus (16)

April 1999

Technical & Management Practices Integrated

Disciplined Process
6 KPAs

Repeatable (121)
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Oct 1996

Project Management Practices Institutionalized

Level 1 - Initial

Topics

- **Management Concepts**
  - Understanding Business Risk
  - Understanding Information
  - Process Capability
  - Process Maturity
  - Process Improvement
- **Capability Maturity Model**
  - Framework for Achieving Productivity, Quality & Control Goals
  - Inside the Software Factory
  - Defect Prevention

To Risk

To try is ***to risk*** failure.

To live is ***to risk*** dying.

To hope is ***to risk*** despair.

To laugh is ***to risk*** appearing the fool.

To weep is ***to risk*** appearing sentimental.

To love is ***to risk*** not being loved in return.

To reach out for another is ***to risk*** involvement.

To expose feelings is ***to risk*** exposing your true self.

To place your ideas, your dreams in front of a crowd is ***to risk*** their loss.

But the greatest hazard in life is ***to risk*** nothing.

The person who risks nothing - does nothing, has nothing and is nothing.

Anonymous

Understanding Business Risk

Project Risk

- **Functionality** (& Defects)
- **Budget**
- **Schedule**

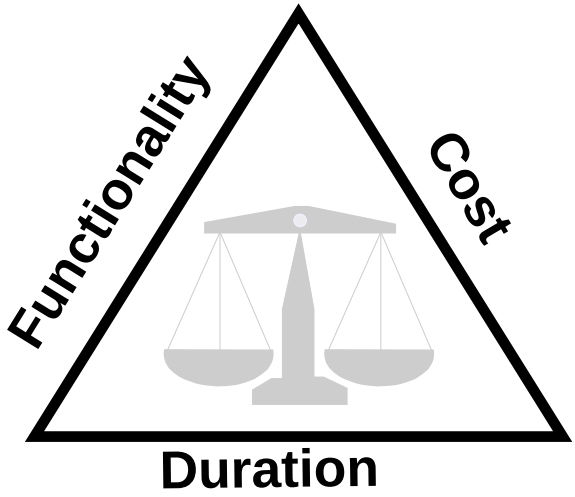
Organizational Risk

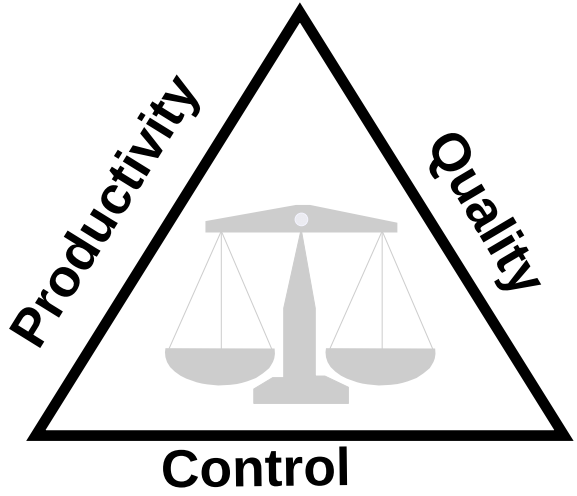
- **Productivity, Quality, Control**

Constraints

- **Limited resources ($$, tools, trained staff)**
- **Limited time**
- **Limited information / knowledge**

Understanding Business Risk





Project Level

Organization Level

Our actions are based on understanding of information available

Understanding Information

Information

- **Random and miscellaneous**
- **Useful when analyzed, interpreted and assimilated**

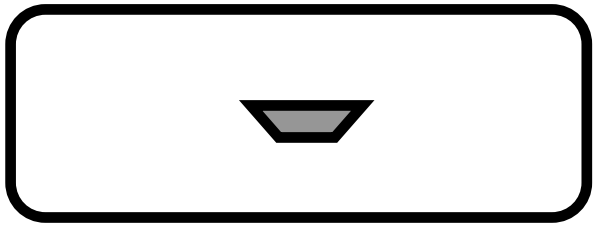
Knowledge

- **Orderly and cumulative**
- **Locked up inside the information**

Data

- **If you cannot express in numbers, your knowledge is limited**

Using Information



"Managing a company by means of the monthly report is like trying to drive a car by watching the the rear-view mirror."

Myron Tribus

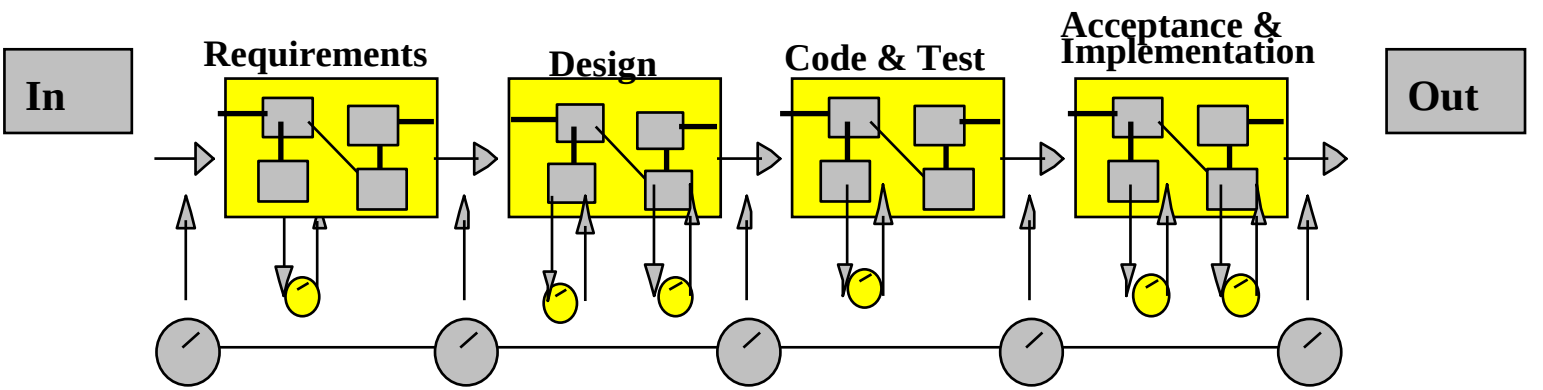
Quantitative Control of Product & Process

Q1 Size Variance

Q3 Duration Variance

Q2 Effort/Cost Variance

Q4 Defect Density



Understanding Variance

Variance	Special Cause / Corrective Action
Effort Variance = -33%	Historic productivity used during estimation of small & large projects can not be the same.
Effort/Cost Variance = 19%	Projects involving multiple development groups require additional inter-group co-ordination. Effort adjustment factor needs to be higher for such projects.
Duration Variance = 77.5%	Resource availability parameter used in estimation needs to be lower for resources supporting production applications.
Size Variance (Coding Phase) = 21%	Identified more user interface. Functions should be broken down to all objects being built.
Effort Variance (Coding Phase) = -34%	Use Effort Adjustment Factor of less than 1 (e.g.. 0.8) when resource assigned has high level of expertise.
Duration Variance (Design Phase) = 42%	Revise tracking process to exclude duration for which project was on hold.
Defect Goal Variance (Requirement Phase)	Defect density being used was based on last years data, Needs to be revised based on more current data.
Defect Goal Variance (Requirement Phase)	User was unable to clarify all requirements up front. Anticipating more defects in UAT defect density was increased from .05 to .10
Defect Goal Revised (Design Phase)	Goal revised due to size reduction (scope change)

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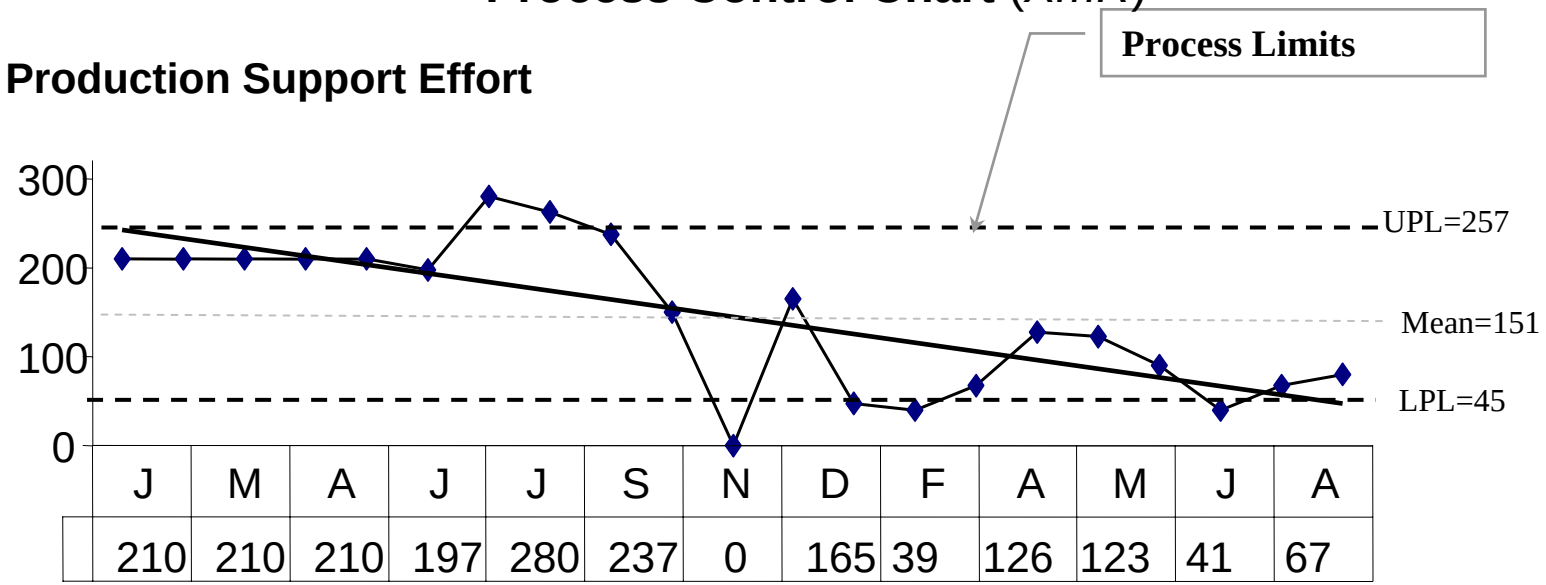
Process capability – the range of expected results that can be achieved based on past performance results.

Process Control Chart (*XmR*)



M = Mean = Average (Y_i), Where i = 1..n = 151

U = UPL= Mean + 2.66(Average (Y_i-Y_{i-1})), Where i = 1..n = 151+2.66*39.8 = 257

L = LPL= Mean - 2.66(Average (Y_i-Y_{i-1})), Where i = 1..n = 151 - 2.66*39.8 = 45

Process Capability

Process Control Charts

"If you do not know how to verify a particular probability model, or do not care, you can still use an XmR chart."

***

"The actual technique, the computation and the graphs are quite simple. The way of thinking - understanding of variation needs to be cultivated. This takes both time and practice."

Donald J. Wheeler

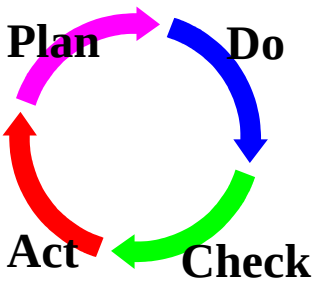
Process Maturity

Extent to which a specific process is:

- **Supported by senior management**
- **Explicitly defined** (who, what, when, how, inputs, outputs)
- **Understood** (training)
- **Used** (incentive)
- **Measured**
- **Controlled** (who, what, when, how, inputs, outputs)
- **Supported by technology**
- **Able to improve**

Maturity Level Assessments

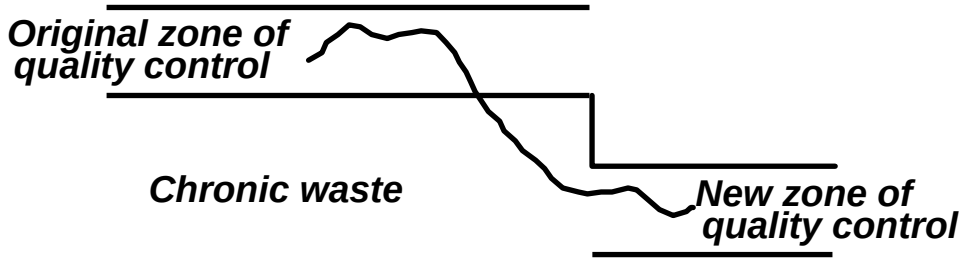
Beware of entropy !!!



Process Improvement

- Understand current process
- Define desired state
- Develop a plan
- Commit resources
- Check status

Control Chart With Common Causes



Identify and eliminate chronic causes of poor performance

Process Improvement - Indicators

General Dynamics (March 2002)**:**

From: http://www.stsc.hill.af.mil/crosstalk/2002/03/diaz.html

CMM Level	Percent Rework	Phase Containment Effectiveness	* CRUD Density per KSLOC	Productivity Factor
2	23.2%	25.5%	3.20	1 x
3	14.3%	41.5%	0.90	2 x
4	9.5%	62.3%	0.22	1.9 x
5	6.8%	87.3%	0.19	2.9 x

Percent rework is a measure of the percentage of the project development time that was expended due to rework. Phase containment effectiveness is a measure of defect containment within the phase in which it was created. Higher phase containment is equivalent to early detection of defects within the same phase in which it was created. Predicted quality is defined as the number of latent defects or Customer Reported Unique Defects (CRUD) per thousand source lines of code (KSLOC). Productivity is displayed in X factor terms that are defined as the productivity average of all programs within a certain CMM level divided by the productivity average of all Level 2 programs.

Capability Maturity Model

Framework for Process Improvement

Capability Maturity Model

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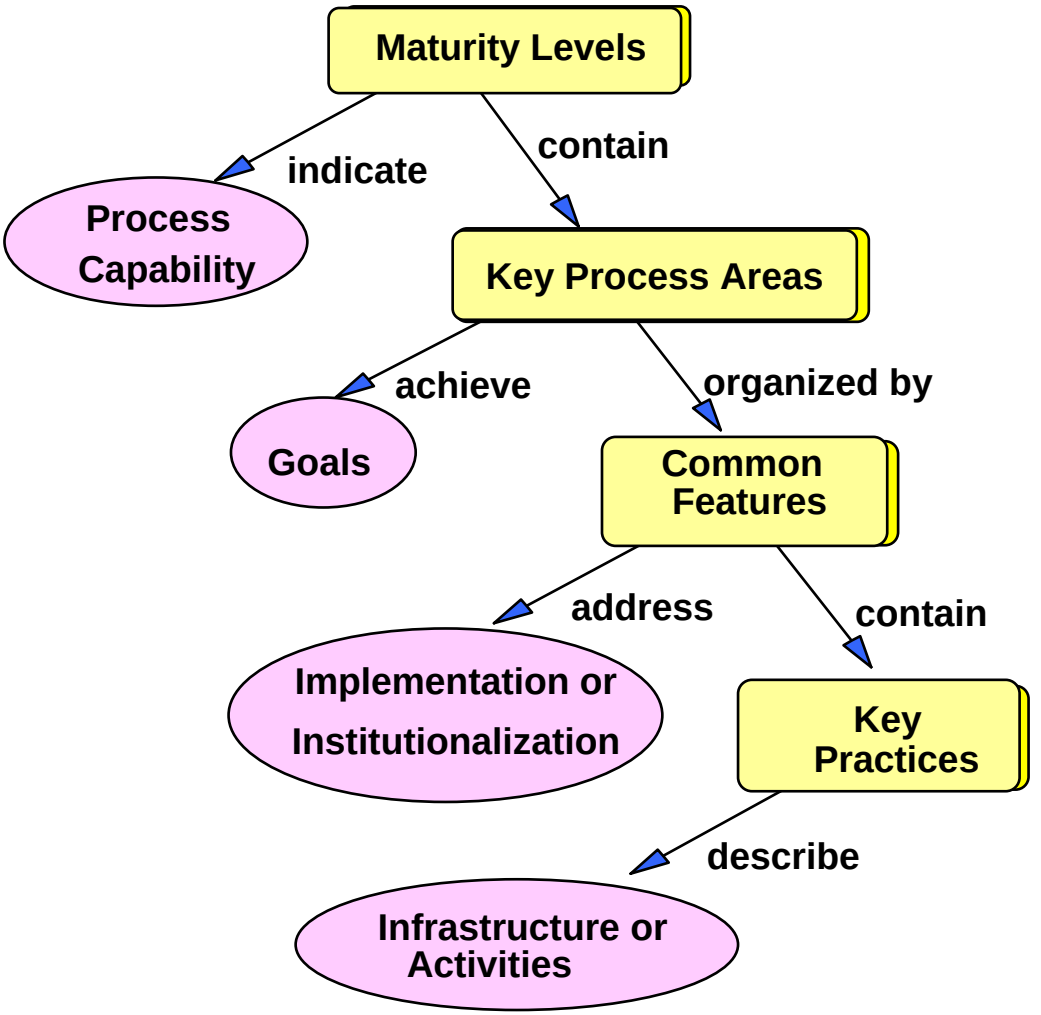

Maturity Levels
indicate
contain
Process Capability
Key Process Areas
achieve
organized by
Goals
Common Features
address
contain
Implementation or Institutionalization
Key Practices
describe
Infrastructure or Activities

Inside the Software Factory

Evolutionary Improvements

Project Level	Organization Level
• Initial	
• Level I to II	
• Level II to III	• Level II to III
• Level III to IV	• Level III to IV
• Level IV to V	• Level IV to V

Project Level	Organization Level
• Initial	
• Level I to II	
• Level II to III	• Level II to III
• Level III to IV	• Level III to IV
• Level IV to V	• Level IV to V

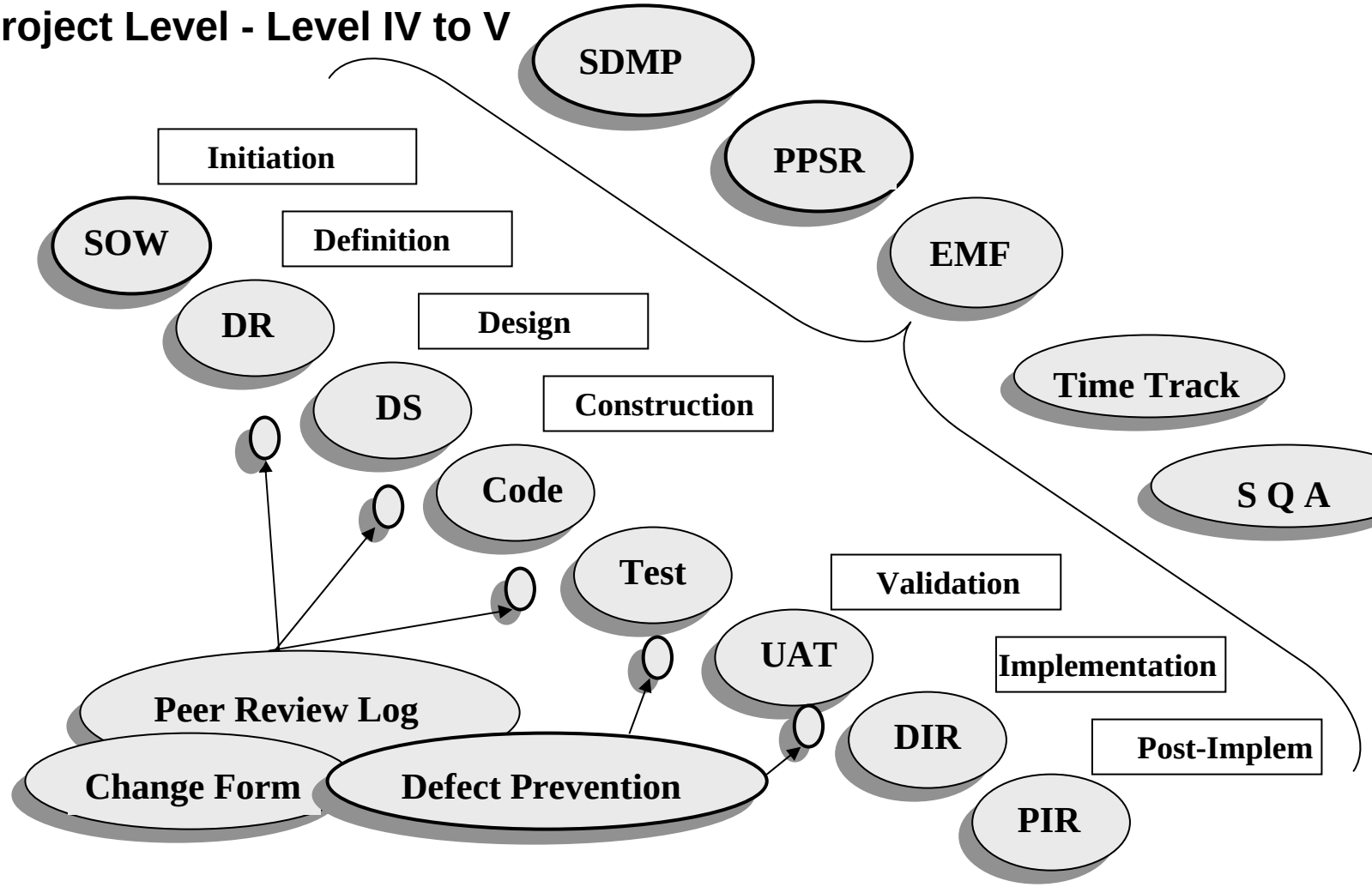
Abbreviations:

SOW (Statement of Work), DR (Detailed Requirements), DS (Design Spec.), UAT (User Acp't Test), DIR (Detailed Implementation requirements), PIR (Post Implementation Review)

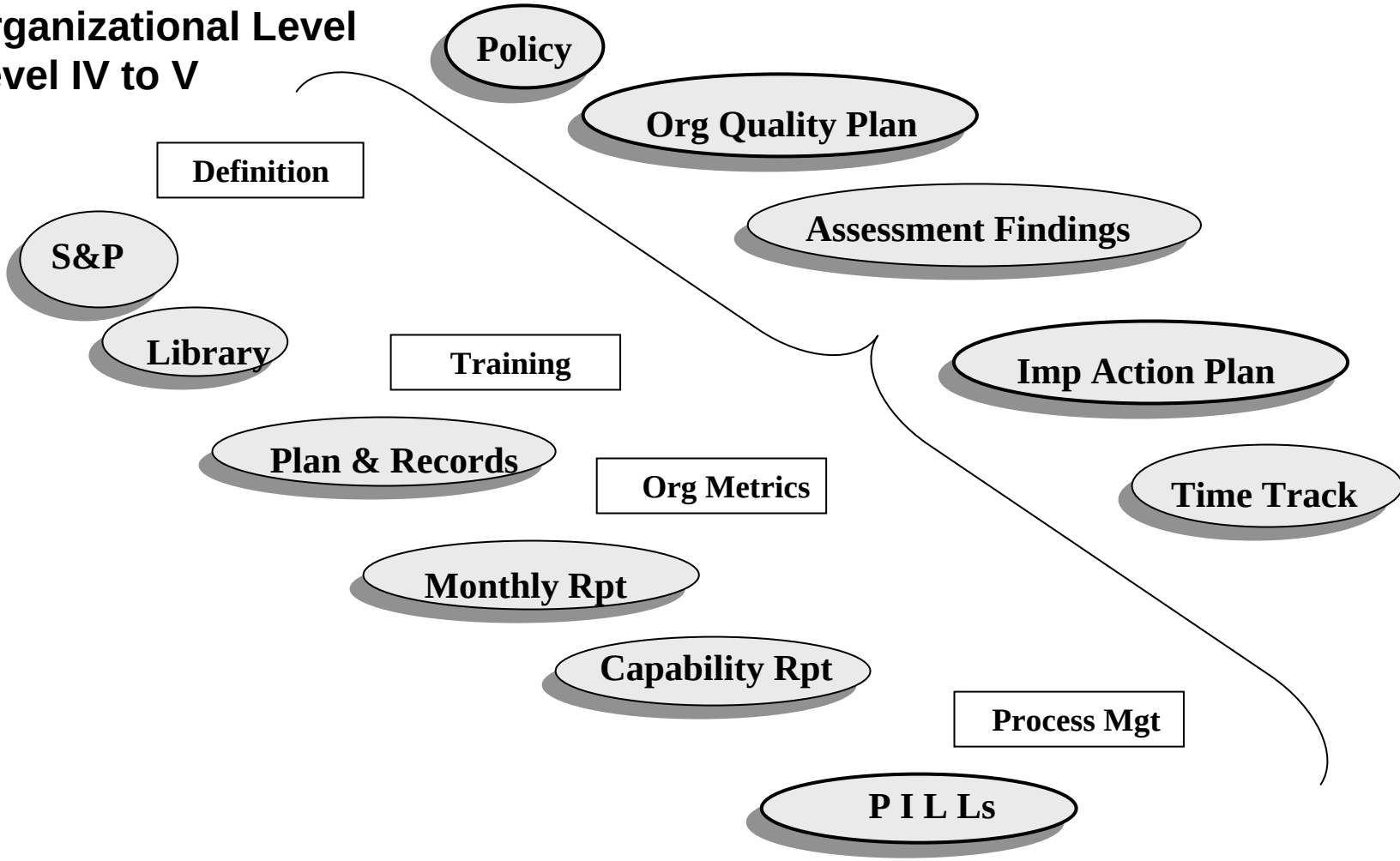
SDMP (Sw Devp. & Maintenance Plan), PPSR (Project Plan & Status Report), EMF (Estimate Mgt. Form), SQA (Sw Quality Assurance)

S&P (Standards & Procedures), PILL (Process Improvement Lessons Learned)

Project Level - Level IV to V



Organizational Level
Level IV to V



On-line Performance Dashboard

Projects

- Duration Variance – # & %
- Cost Variance – # & %
- Avg. cost per FP
- Avg. Delivery Rate
- Reusable Asset Contribution
- Count by Status
- Client Charge back
- Avg. Client Rating
- Avg. Team Rating
- Data Quality Alerts

Systems

- Reusable Asset Value
- Production Support Cost Variance
- Production Support Cost per FP
- Total Applications
- Total Function Points (Prod)
- Production Support Cost Details
- Application Outages
- Online Availability %
- Avg. Outage Duration
- Problem Tickets by Summary
- # of Open / Closed Tickets

HAWTHORNE EFFECT !!!!

QA Non-compliance Tracking

Projects Process

- Upon phase completion
  - Documentation not completed
  - Non-compliances pending
- Greater than 3 phases active
- Planned reviews not held
- Sign-offs missing
- Effort incorrectly booked for time tracking

Projects Work Products

- Appropriate templates used
- All sections completed
- Unambiguous and verifiable statements
- Forward and backward traceabilty established
- Correct versioning
- Risk & issues documented

HAWTHORNE EFFECT !!!!

Defect Prevention

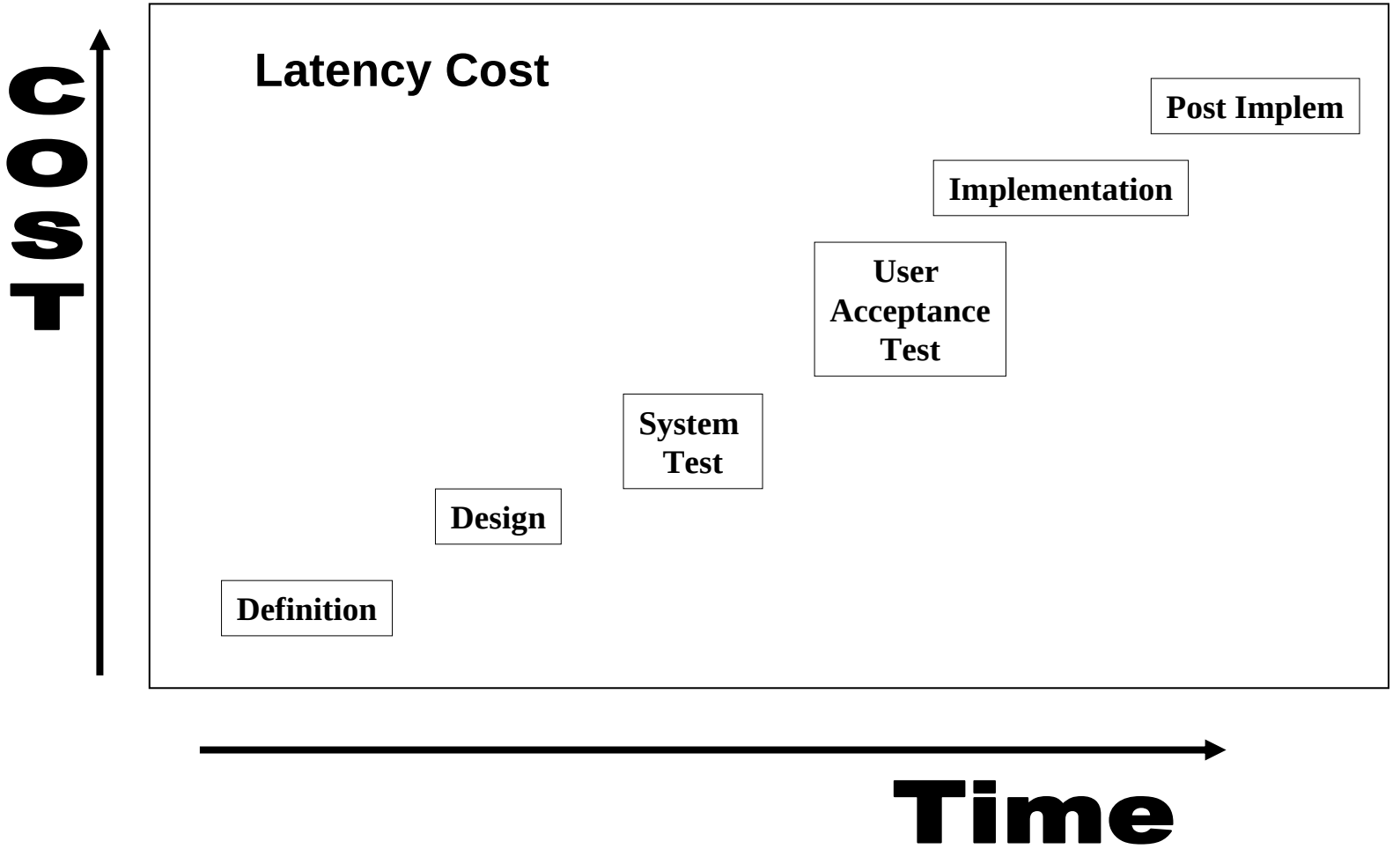
Every defect is an opportunity for improvement

Defects occur when complexity of the business need exceeds the method used to address it.

Defect Prevention

Benefits

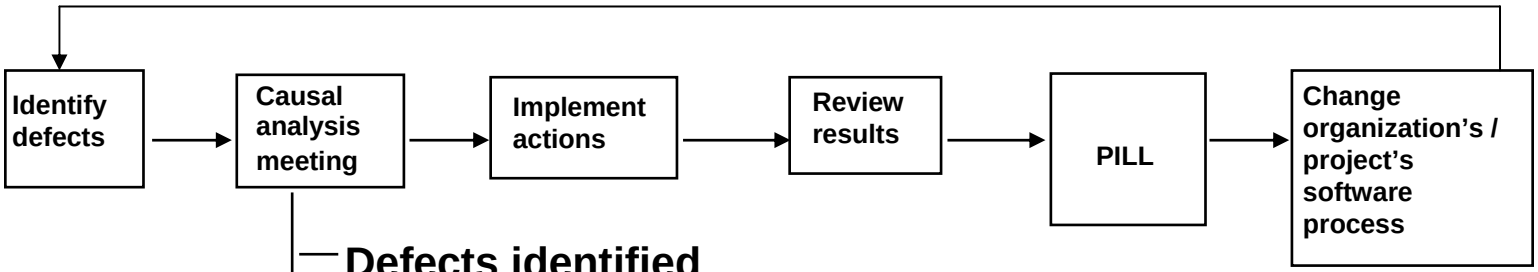
- Cost of prevention is far less than detection & repair
- Involves the entire team - cross training
- Sharing lessons learned from other projects
- Improvement visible to sponsor & customers


Latency Cost
Post Implem
Implementation
User Acceptance Test
System Test
Design
Definition
COST
Time

Fixing Problems Before They Happen

Focus is on causal analysis.

- **what in the process permitted the defect to occur**
- **what in the process needs to be corrected to prevent the defect from occurring in the future**



- **Defects identified**
- **Root causes determined**
- **Common causes identified**
- **Actions proposed**
- **Cost benefit analysis**

PILL: Process Improvement Lessons Learned

Defect Prevention

Requires

- Precise process discipline
- Standards for work products
- Consistent method to identify defects
  - Peer review criteria and checklists
  - Test procedures and test cases

Involves

- Classifying defects
- Analyzing cause
- Developing action plan
- Tracking implementation
- Measuring improvement
- Spreading lessons learned

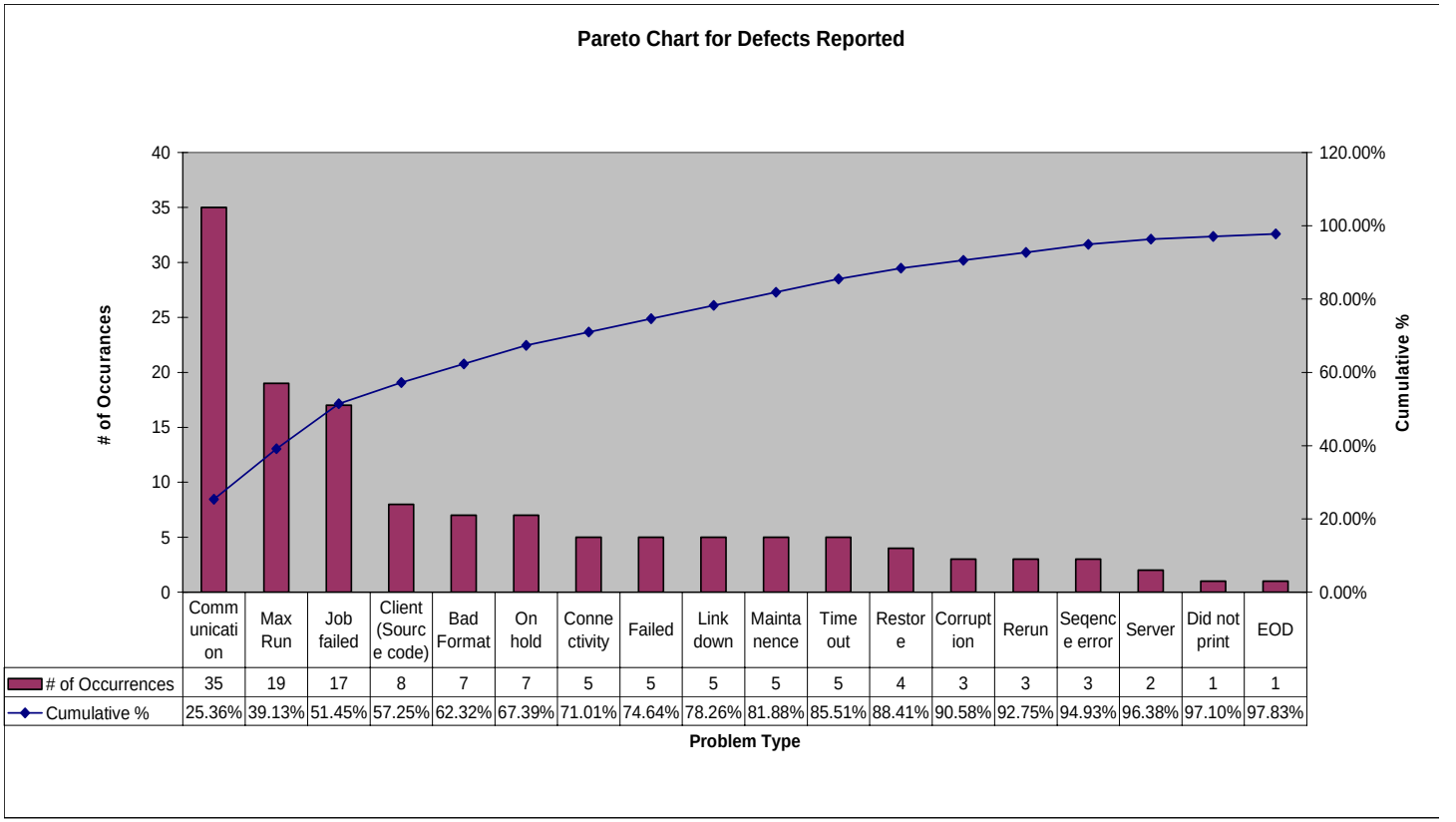
Defect Prevention

Peer Review Checklist - Sample

Design Peer Review

- ☐ Each design spec is consistent with each other and traceable to the detailed requirements
- ☐ All interfaces between the modules of the system are described
- ☐ All entities and entity relationships are considered
- ☐ All design considerations and assumptions are documented and verified
- ☐ Correct protocols are used to transfer data or to communicate with the interfacing systems
- ☐ Provisions are made for recovery and restart from hardware or software failures
- ☐ A common security shell exists
- ☐ Management of data integrity has been considered
- ☐ Naming conventions have been defined and adhered to
- ☐ Changes to detailed requirements have been incorporated into the design specs

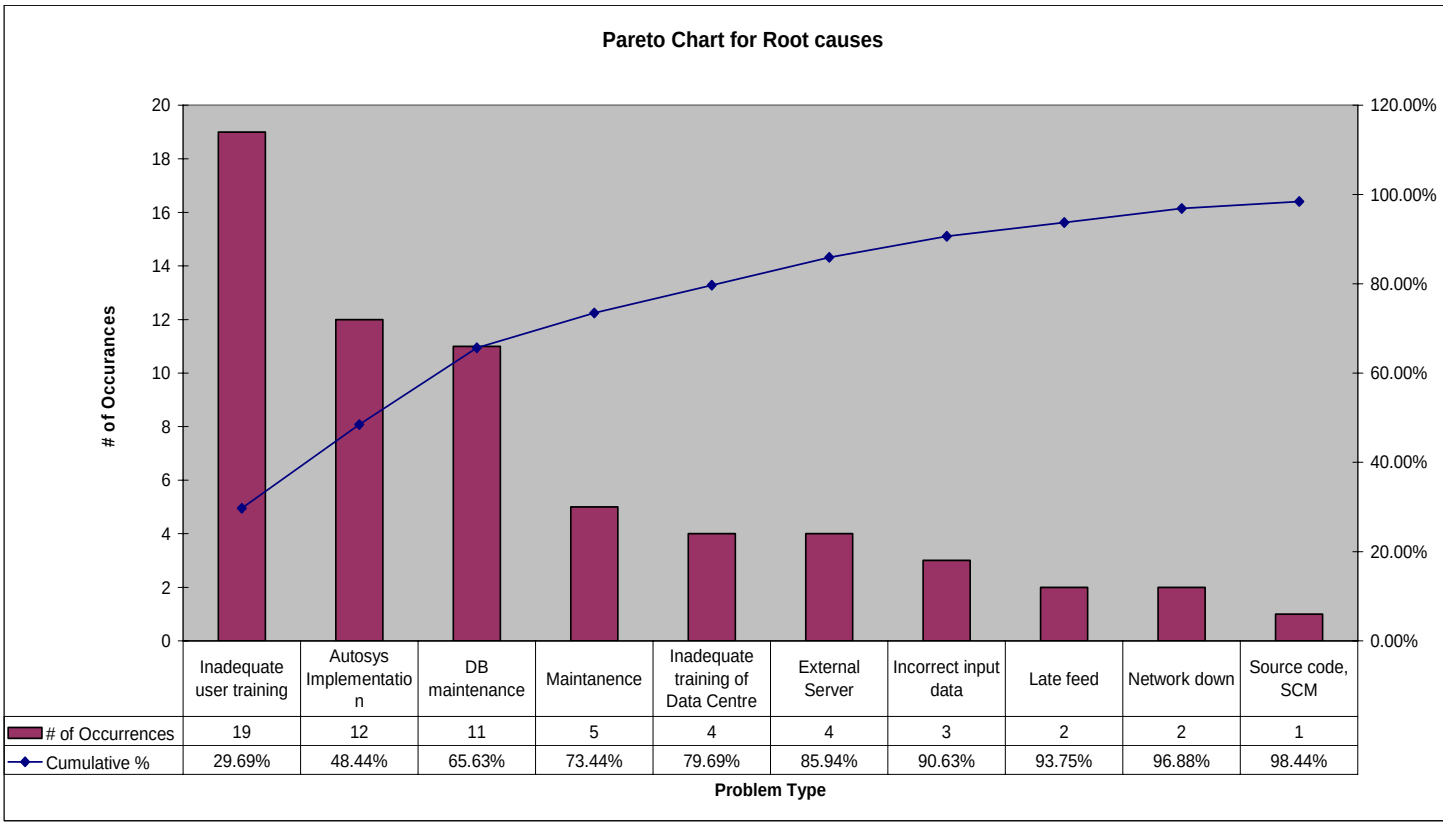
Pareto Chart: Defect Type - Sample



	Communication	Max Run	Job failed	Client (Source code)	Bad Format	On hold	Connectivity	Failed	Link down	Maintanence	Time out	Restore	Corruption	Rerun	Seqence error	Server	Did not print	EOD
# of Occurrences	35	19	17	8	7	7	5	5	5	5	5	4	3	3	3	2	1	1
Cumulative %	25.36%	39.13%	51.45%	57.25%	62.32%	67.39%	71.01%	74.64%	78.26%	81.88%	85.51%	88.41%	90.58%	92.75%	94.93%	96.38%	97.10%	97.83%

Problem Type

Pareto Chart: Root Causes - Sample



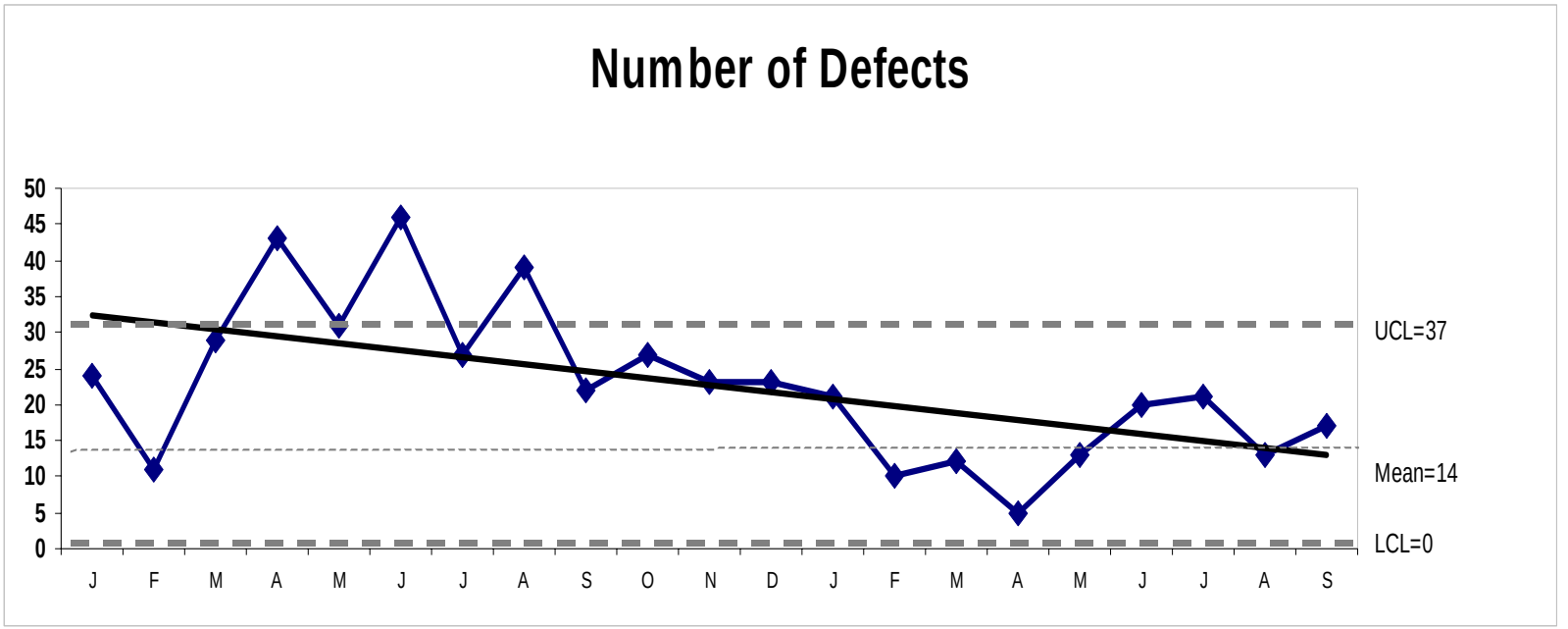
	Inadequate user training	Autosys Implementation	DB maintenance	Maintanence	Inadequate training of Data Centre	External Server	Incorrect input data	Late feed	Network down	Source code, SCM
# of Occurrences	19	12	11	5	4	4	3	2	2	1
Cumulative %	29.69%	48.44%	65.63%	73.44%	79.69%	85.94%	90.63%	93.75%	96.88%	98.44%

DP Action Plan - Sample

- Root Cause
- Action Proposal
- Assigned to
- Due Date
- Comments

#	Root Cause		Action Proposal	Assigned to	Due Date	Comments
II	DB maintenance	1	Index rebuild to be done every 2 weeks.	Tom	End July	
		2	Optimising indexes.	Jack	End July	
III	Auto Implementation	1	Review all Max Alarm settingsand retain only essential ones.	Ann	End Oct	
		2	Peer review of Auto design by Auto experts.	Joe	End Oct	

Defects Trend - Sample



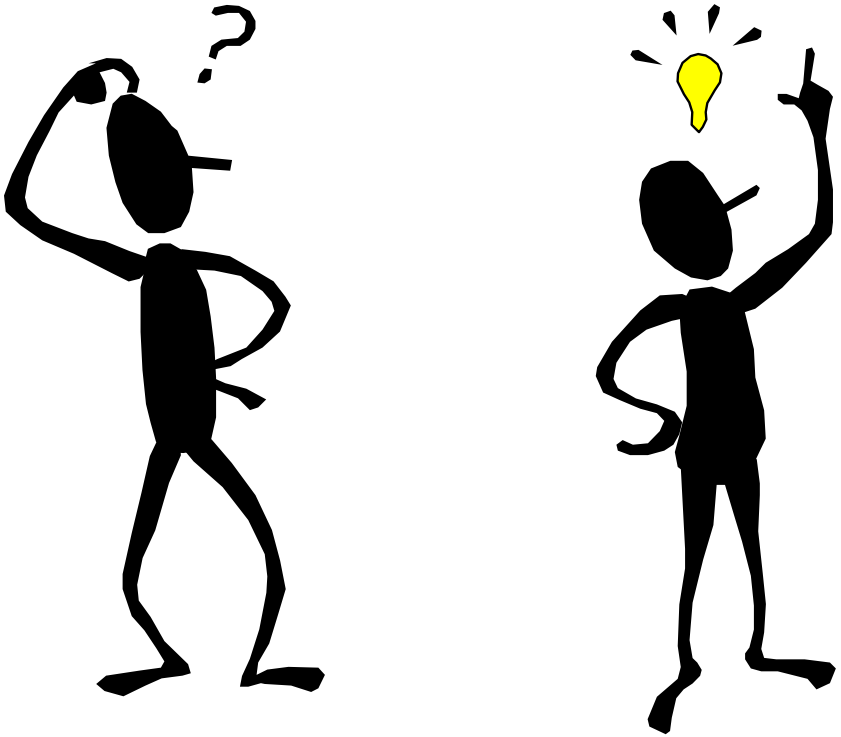
Conclusion

"Defect prevention takes time. Stick to it until the benefits are apparent. If you don't see results in about six months, you are probably doing something wrong.

Defect prevention is not a modest change in the software process; it is an entirely new way of life that will transform your organization."

Watts Humphrey

Questions and Answers



Focus on data analysis to improve process and achieve Productivity, Quality and Control goals.

Good Luck

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