Measure for Measure: A Practical Quality Management Program

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Attempts to Manage With Metrics Often Fail

- Organizations collect and report “standard” metrics with no relationship to projects or business goals
- Data are sporadic or incomplete, reports are ignored by management
- Amounts to no more than “feeding the corporate gorilla”

Can We Do It Right?

- What we have
  - Strong measurement culture
  - Maturity Level 3 process capability
- What we want:
  - Statistical process management capability
  - Management demand for quality metrics reports
  - Team member understanding of metrics use
  - Firm foundation for measuring performance and driving continuous product and process improvement

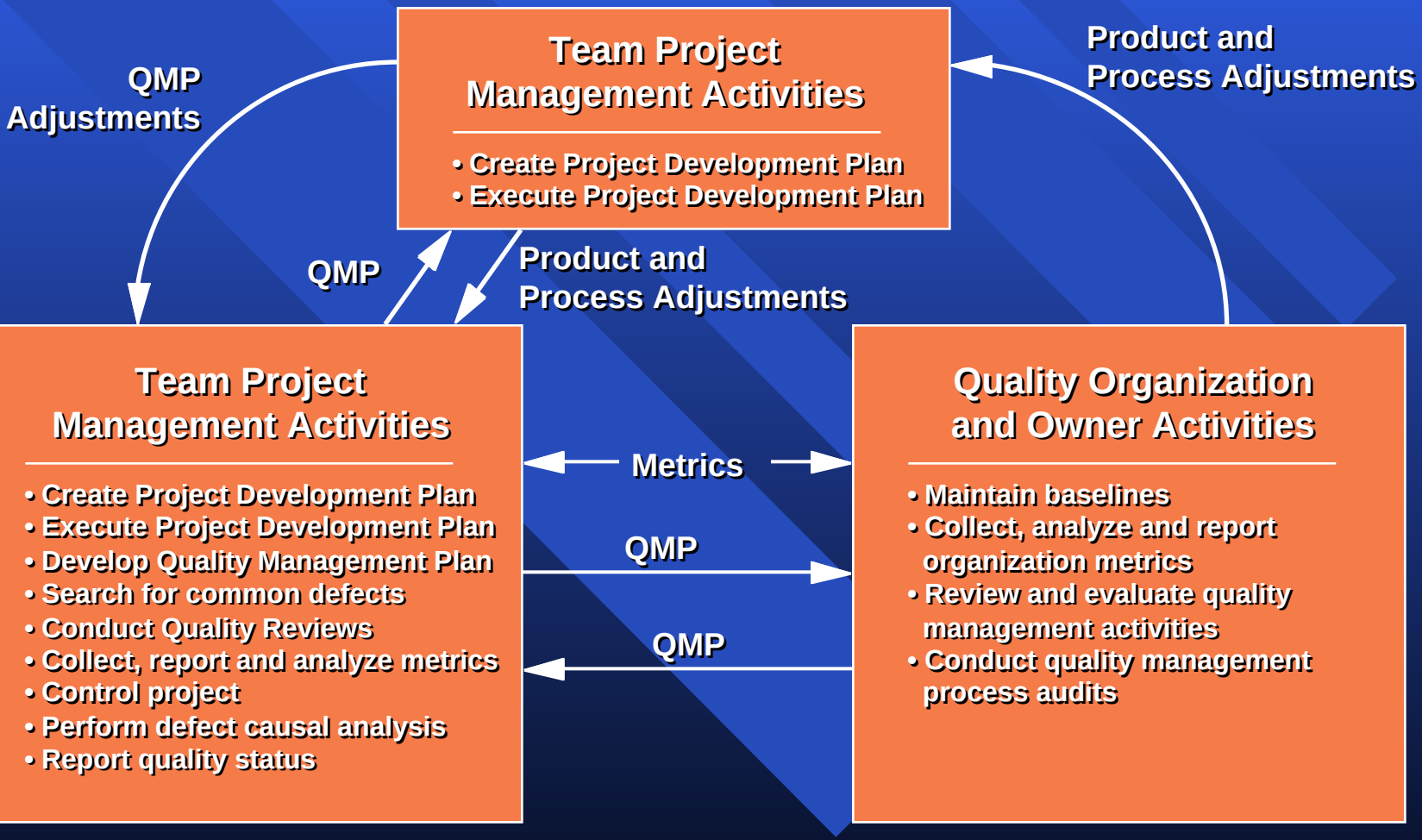
The Motorola SPS Quality Management Program

- Business-oriented quality management plans with proper scope and rational goals
- Quality attributes with significant business value and commitment of a named owner
- Review performance against quality goals
- Use metrics to manage activities and make product and process change decisions
- Establish a stable and capable development and support environment

All Products, All Phases of the Product Life Cycle

- New system and product development
- Integration of purchased components
- Updates or enhancements to existing systems or products
- Manufacturing
- Sustaining engineering and support of released products
- Infrastructure support
- Process improvement activities

The Quality Management Process



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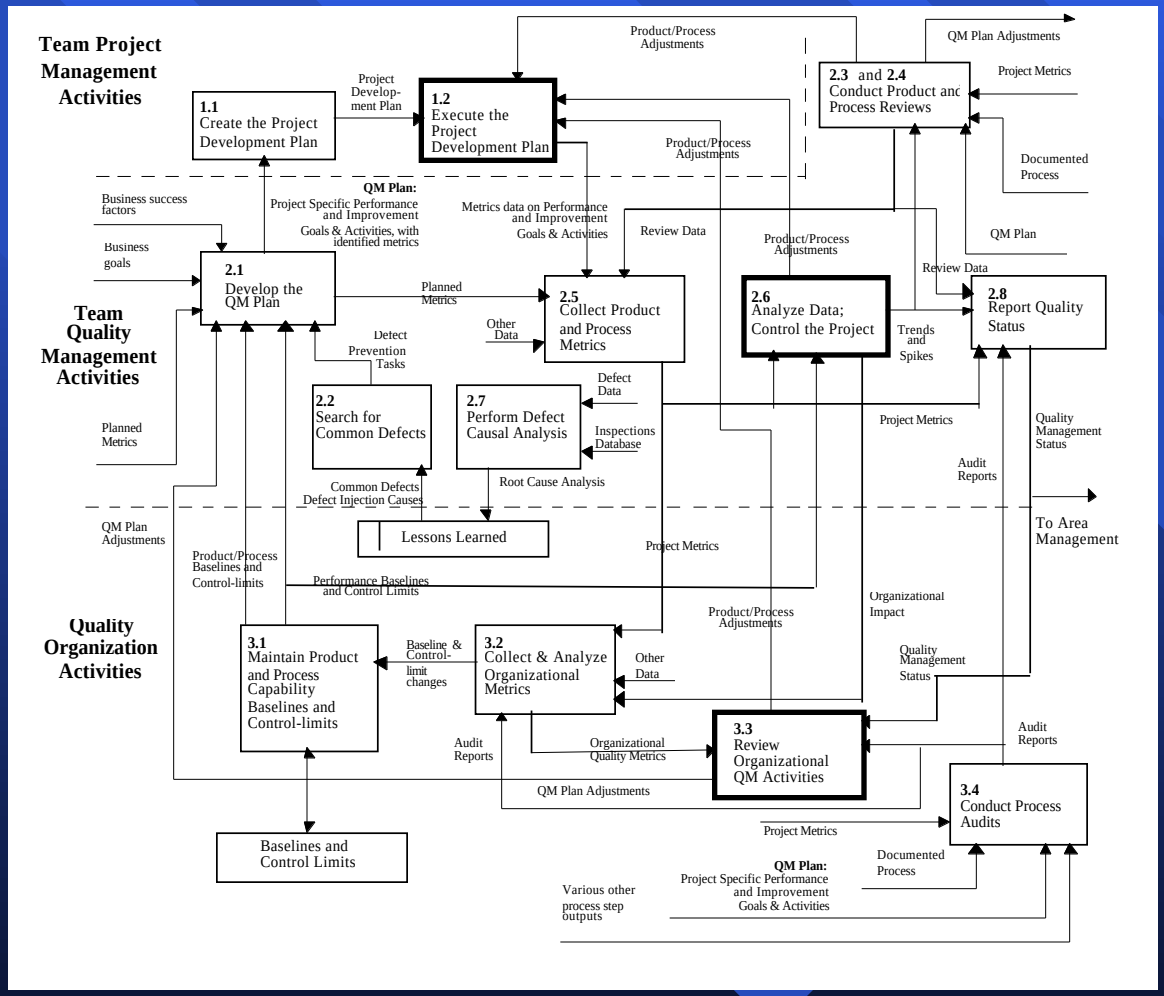
Quality Management Process



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Quality Management Program Objectives and Success Criteria

Objective	Satisfied When
Provide engineering teams with the ability to set realistic product and process quality goals, based upon business needs	- Process capability baselines are established by all teams - All teams are using the Quality Management Program with goal-oriented metrics
Improve the ability of teams to manage the quality of their deliverables throughout the life cycle.	- All teams have had adequate training on the Quality Management Program - A support structure exists to capture, report, and analyze metrics and data
Institutionalize quality management processes, standards, and procedures that have been approved by the EPG.	- Assessments of the QMP program and its execution indicate this is true.
Systematically eliminate the introduction of defects into the development environment	- Defect reduction plans are in place and shown to be working. - In-process faults and post release defects trend is toward zero.

Quality Management Policy

- The General Manager has ultimate responsibility for the organization's quality
- Every development, sustaining and service team shall use a quality management plan
- Hold periodic quality reviews of plans, goals, performance, actions, defect prevention, and continuous improvement
- Track and report quality review process effectiveness

The Quality Management Plan

- Defined at the project/product, department and organization level
- Contains a set of scope-appropriate quality attribute management plans
- Essential requirements for quality attributes:
  - Must support an identified product or process business goal
  - Must have an identified owner with responsibility and authority to allocate resources and direct actions toward achieving the goal

Quality Management Plans Organization

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Building a Quality Attribute Management Plan

- Propose several quality attributes and make the business case for for managing them
- Business success factors make the quality attribute relevant
- Business goals define a performance level for each of the defined business success factors
- The quality attribute owner is its champion, typically the project leader, department manager or organization general manager

Quality Attribute Identification

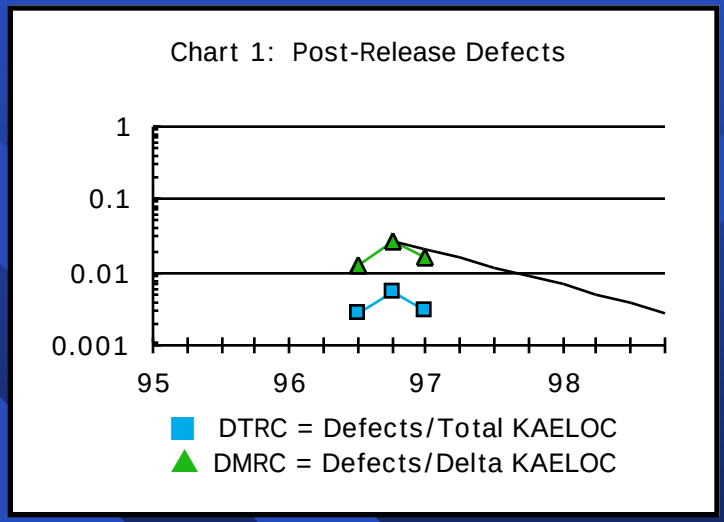
Quality Attribute Title:	**Post-Release Software Defects:** The internal view of delivered defects
Business Success Factors:	• Establishment of Six-Sigma (or better) quality in delivered software products enhances customer acceptance. • Reducing the time spent in rework allows more time for value-added development.
Business Goal:	Minimize customer's probability of encountering defects in released software.
Scope:	Organization Level
Owner:	General Manager

Use Operational Questions to Characterize Goals (GQM)

- Example questions in support of the goal "minimize the customer's discovery of defects in released product":
  - For what products are released defects measured?
  - What's the baseline defect rate for each product?
  - What's the current defect density in each product?
  - What's the distribution of defect types?
  - Where were defects injected?
  - How quickly are defects fixed?
  - How many are open right now?

Define Metrics

- Derive metrics from operational questions
- Define metric details:
  - Algorithm and data
  - Where reviewed
  - Data source
  - Responsibility for compiling, computing and publishing
  - Management review questions
  - Sample chart or graph



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Metrics Data Definition

M #	Data Element	Data Source	Frequency of Collection	Responsible
1 2 3	Baseline fault density for total and modified released code	Organization process database	Once; Update as needed	Department EPG reps; Chief SW Engr.; SQA Manager
1 2 3	Sizes of base, new, and total released software for each product or project measured.	Project configuration management systems	Quarterly	Department EPG reps; SQA Manager
1 2 3	Number of faults reported in new and delta software released.	Project defect tracking systems	Quarterly	Department EPG reps; SQA Manager

Every Metric Must Have …

- Connection to a business success indicator
- An owner who will use it to manage the business at the specified scope
- Two-way responsibility:
  - Owner needs it to run the business
  - Metric producer knows it will be used

Performance Baselines, Goals and Action Triggers

- For each metric, we define:
  - The baseline (nominal expected) performance for each specified metric
  - The performance goal to be achieved within the scope of the plan
  - The control limits (if known)
  - The preventative action trigger
  - The corrective action trigger
- Goals can be specific target values, trends, tightening of control limits, etc.

Baselines, Control Limits, Goals and Triggers

M #	Baseline & Control Limits	Performance Goal	Preventative Action Trigger	Corrective Action Trigger.
1	DTRC = 4 dpm (0.004 Defects/KAELOC)	DTRC = 1 dpm by 1Q1998	DTRC greater than previous report	DTRC > 8 dpm for two consecutive reports
2	DMRC = 20 dpm (0.020 Defects/KAELOC)	DMRC = 8 dpm by 1Q1998	DMRC greater than previous report	DMRC > 30 dpm for two consecutive reports
3	8X (60% per year)	10X every two years (68% per year)	DMRC X-Factor below goal rate	DMRC X-Factor below goal rate for more than two consecutive reports

Management Review Plan

- The Quality Plan includes a description of how its performance will be reviewed:
  - Type and frequency of review meetings
  - Metrics and goals to be reviewed
  - Essential attendees
- Management review questions included in each Quality Plan probe beneath the reported metrics for greater understanding

Management Review Questions

Q#	M#	Post-Release Defects Questions
1	1, 2	How much software did we release in the reporting period? How much was new?
2	1, 2	How much total software is in release and currently supported??
3	1, 2	What types and severities of defects were reported in post-release software? Do we have plans to control them?
4	1, 2	What software had the most problems? Why?
5	3	What are the root causes? What are we doing about them?
6	1, 2	How many of the released defects were found by our users?
7	3	How many problems did we fix last quarter? How long does a fix take?
8	3	How many remain unfixed? Why?

Other Quality Plan Components

- Metric References
  - Detailed reference, including all data definitions, algorithms, formulas, etc.
- Defect Prevention Plan
  - Activities that will result in a lower defect injection rate (not relevant to all quality attributes)
- Strategic Improvement Plan
  - Long-term activities to effect improvement in several quality attributes (may not be relevant at pro level scope)

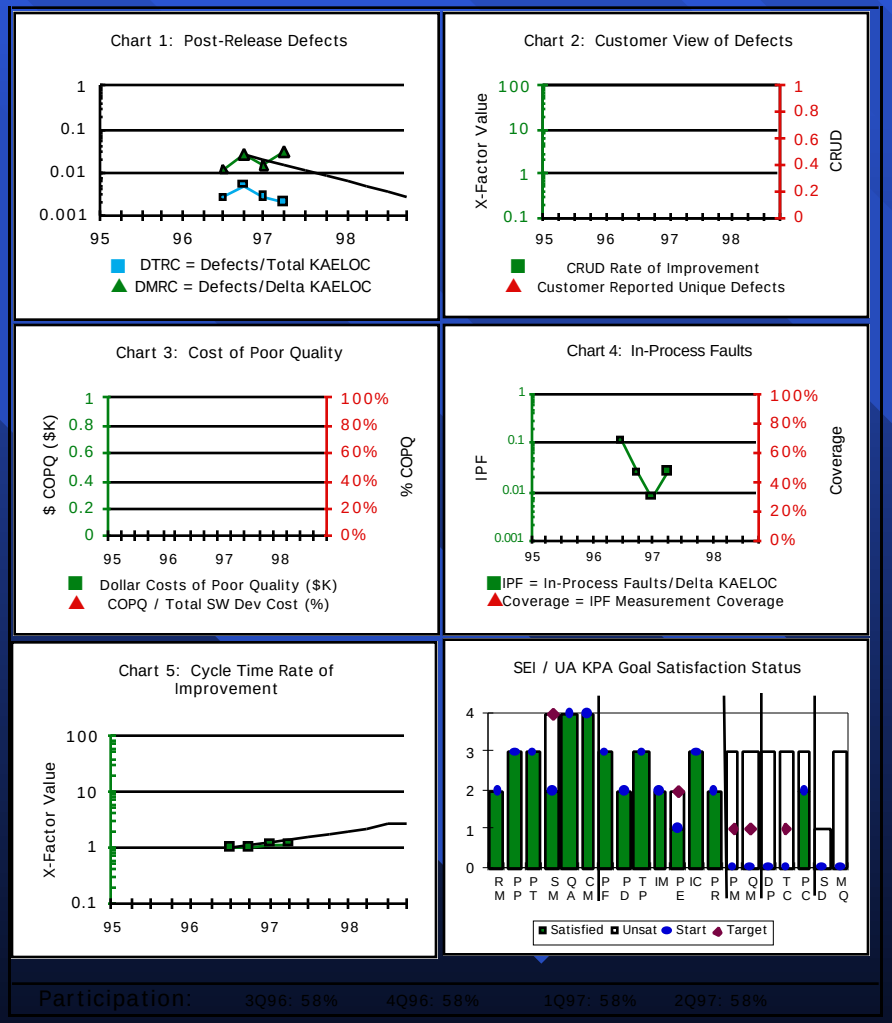
Quality Reviews

- The performance of a project, department or organization, shown by its quality metrics, is reviewed by management
- Conducted as a regular part of our monthly organization operations review
- Roles defined for:
  - Manager
  - Team member
  - Attribute owner
  - SQA Manager

Quality Review Process

- A quorum is required (manager, owner, team members, quality representative)
- Projects present:
  - Current quality metrics charts with appropriate backup data and context descriptions
  - Content and status (triggers) of preventative and corrective action plans
  - Defect prevention, strategic improvement plans
- Managers responsible for review questions

An Organization Level Metrics Report



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Quality Management Program Assessment

- Key issues for success: commitment, resources, training
- Self-evaluations of the program look at:
  - Definition and approval of policy and procedures
  - Metrics and review support environment
  - Training of participants
  - Execution: Reviews are held and action plans developed and worked

Rating	Criteria
1	No work done.
2	Some work done, but still significant work to do.
3	Almost all work done, small additional tasks remain.
4	All work accomplished.

Conclusions

- Our Quality Management Program:
  - Aligns quality management with business success
  - Keeps activities within a tractable scope
  - Ensures relevance through ownership and regular management quality reviews
  - Uses a simple, tailorable, statistically based quality plan template
  - Provides a firm foundation for measuring performance and driving continuous product and process improvement in any engineering discipline
  - Provides a solid way to satisfy SEI Level-4

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