Project Quality Reviews & Audits
Recall: The 5 Phases of Project Management

Feasibility  
Design, Planning  
Development  
Closeout  
Operations

Finance  Organization  Monitoring and Control
Evaluation  Estimation  Project Aberrations
Planning  Changes and Claims
Quality, Reviews, and Audits

Figure by MIT OCW.
Contents of this Lecture

- Quality Performance – What are the issues?
- Project Reviews
- Project Audits – What are they?
Quality Performance – What are the Issues?

- Who cares? Also, is QP influenced by construction method?
- Interrelationships between Quality and the other performance metrics (Time, Cost)
- Quality Control
- Quality Assurance
- Quality Management
- Total Quality Management (TQM)

Note: In recent years – increasing focus on Quality, particularly on federal contracts
Project Quality – Who Cares?

**Owner**
- Resident Project Representative
- Architect’s superintendent

**Manufacturers**
- Prefabrication factory inspector

**Utility companies**
- Site inspectors

**Project Developer/Contractor**
- Field manager
- Quality manager
- Foremen

**Other Stakeholders**
- The general public (or its reps) e.g., Local building department (code compliance)
- Safety and health inspectors (U.S. OSHA)
- Insurance company inspectors
- Financial institution inspectors
How is Quality Related to Construction Method?

Method 1 - Product may be produced elsewhere and then brought to site, ...

Photographs removed due to copyright restrictions.
... or Method 2 - product may be produced at the Site

Photographs removed due to copyright restrictions.
So, … Is Product Quality Related to Construction Method?

Many ways of classifying construction methods. One way is whether Project’s physical component are…

- created on site (concrete cast in-situ) OR
- created elsewhere and brought to site (precast concrete)

Pre-fabricated components: generally higher quality

- Tighter tolerances
- Manufactured under tightly-controlled conditions
- More rigorous quality control mechanisms
- Shortcoming: Longer delay if identify problems!

Site-created components: generally lower quality

- Vulnerable to Weather effects, relaxed adherence to standards, etc.
Quality Inspections of Externally-produced Components

- Inspection may occur at the source (factory) or after they are delivered at the site.

- Examples of external sites
  - Precast concrete plants
  - Steel plate fabrication plants
  - Concrete production plants
  - Welded steel plants
  - Large, specialized pieces of equipment

- Quality checks at external fabrication site OR at project site can be carried out by Owner (or his rep), or the Contractor

- May also monitor product quality DURING transport of the product
Quality Control vs. Quality Assurance: What’s the Difference?
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Analogy: You Driving on a Freeway

Driving Quality Assurance
Before Driving: adjust seats, mirrors, temp, etc.
During Driving:
  Occasional glances at:
  - speed gage to ensure speed is not excessive
  - side mirror before changing lane
  - road sides to read road signs, etc.
No distractive activities (reading, eating, etc.)

Driving image removed due to copyright restrictions.
Quality Control vs. Quality Assurance: What’s the Difference?

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During and After Driving: Generate/report data to prove that necessary precautions were taken and that your driving did not violate any rules

**Driving Quality Control**

- Swerving to avoid deer crossing the highway
- Steering to right if car is straying into left lane
- Braking to avoid hitting slowed car in front

These are corrective measures
Quality Control vs. Quality Assurance: What’s the Difference?

- **Quality Assurance**: “Do it right the first time”. Preventive Quality checks.

- **Quality Control**: Fix it when ever it goes or is going wrong

But note! In recent years, QA is defined to include QC

Newer Definition of QA:

The acts of (i) establishing that product is being delivered according to all specifications, (2) providing evidence needed to establish confidence that all quality-related activities are being performed effectively

- Includes that part of project monitoring that covers project quality.
- Covers all activities from design, development, production, installation, servicing and documentation
- Includes regulation of the quality of raw materials, assemblies, products and components; services
Quality Control vs. Quality Assurance: What’s the Difference?

**Important**

Exact definitions of QA-QC may vary from...

industry to industry,

agency to agency,

country to country.
The Relationships: Quality Control, Quality Assurance, Project Monitoring

- Project Monitoring
  - Monitoring of other project performance metrics
    (time, money, etc.)

- Quality Assurance
  - Monitoring of project quality

- Quality Control
More on Quality Assurance (QA)

- Involves regular but random testing of materials and workmanship (time-based or work-based intervals)
- Prevent, identify, and correct quality-related problems
- During the production process, QA instructors mostly provide guidance and leadership to the production people rather than criticizing their work
More on Quality Control (QC)

QC mostly carried out by Contractor, but …

the Owners rep. may draw Contractor’s attention to carry out QC at any time. Owner also can have his independent testing.

When the QC Division and Production Division belong to same organization, these parties often have adversarial relationships.

The production people often tend to cover and hide their mistakes by nature.

During/after every project activity, Contractor provides Owner with documentation that the product complies with specifications.
What is Quality Management?

- Initiated and orchestrated by senior managers
- Involves all parts of the organization (main C, sub-C, suppliers, etc.)
- Through a systematic, comprehensive and well-documented QA process
- **Rationale**: Improved QA serves to enhance all other performance metrics of the project (time, cost, etc.) in long run
- **Objective**: A “zero-defects” product
- **Technique**: Preventive as well as corrective -- Ensure quality NOT ONLY by rejecting failures but ALSO by investigating possible risks and threats to quality at root sources
What is Total Quality Management (TQM)?

- Not just an operational strategy for PM – A PM philosophy
- Aimed at continuous improvement of the organization and personal growth of its individual members
- Ensures that the environment surrounding the Product is viewed in the broadest sense including:
  - Quality of Life
  - Well-being and satisfaction of all people Involved
  - Long-lasting relationships with customers and suppliers etc.
Linkages between Quality and Key Performance Metrics

Tradeoffs

Acceleration ⇒ $(Overtime, shift work, Rework, higher-end equipment, better crews etc.)

Need for rework imposes high expenses
High quality needs can lead to costly miscalculations on labor time

Less $ ⇒ Low progress
Resource reduction
Selection of poor quality workers
Default of contractor/subs

Try to save $ Can lead to substitution, lower quality workmanship

Quality problems may result from overtime, shift work, new hires

Quality level impacts speed of work, Level of rework

Slow progress ⇒ $ Delayed occupation,
Higher interest on const. loan
Loss of tenants
Opportunity cost

Time

Quality

$
Going back to examine the product from the project.
- Has product (or part thereof) been produced?
- When was it done? Punctual?
- Was it done right?
- With the needed resources? Within the given time?

Reviews enable us to learn from mistakes as well as successes.

Models used in PM should also be reviewed for their efficacies
- Example CPM, WBS/ OBS/ CBS, fishbone, etc.

Project reviews may be carried out by external parties (e.g. consultants)

However, transience of project activities/teams can impair the accumulation of institutional knowledge and thus can impede Project Learning

Source: F. Pena-Mora 2003
The Need for Project Reviews

Why do we review projects?

- Bridging Gaps
- Validation of Work Done
- Quality Assurance
- Learning
More on the Need for Project Reviews

Why construction projects in particular need formal reviews:

- Design and Planning Phase Generating 75% of the Problems Encountered in the Construction Site ⇒ Need for Understanding and Coordinating the Contract Documents and Technical Specifications

- Current era: construction very fast paced ⇒ Errors More Likely Frequent critical reviews are needed more and more to keep up with the pace.

- Rising requirements for high quality and corporate effectiveness
Other Benefits of Project Reviews

- Knowledge Transfer
- Team Building

These are positive side-effects rather than pursued goals.

Team Building is a much desired side effect particularly for projects that are highly segmented (such as construction projects).
Project Review – How to do it?

**Specific Approaches (Tools) for reviewing projects**

- Peer Reviews
- Project Meetings and Walkthroughs
- Inspection
- Any combo of the above
Project Meetings – A Useful Tool for Project Review

Purposes and Types of Project Meetings

- Assessing what has been done, what has happened?
  - Reviews – Discussion
  - May also include inspections – Visual validation

- Assessing why it has happened: Audits
  - How have resources been used?
How to Conduct a Successful Project Meeting

- Schedule your meetings well ahead of time to increase likelihood of participation.
- Meetings should have well-defined purpose and agenda.
- Keep project meetings very impersonal!
- Goal is to focus on problems rather than people:
  - Discuss process rather than ad-hoc decisions
  - Keep focus on needs of project
- Avoid holding meetings that are perceived as “witch hunting” or challenging some project party or team member
- Recriminating meetings …
  - … do not make progress
  - … can lead to ongoing rifts among personnel
  - … can lead to defensiveness and emotions that can overwhelm rational analysis
Some Categories of Project Reviews

- **Level of the Review**: Technical vs. managerial
- **What is the orientation?** Work output-oriented vs. process-oriented
- **Status of the Reviewers**: Internal review vs. peer review
- **Tool for the Review**: Meetings, Inspections, etc.
Project Reviews at Technical Level

Focus on
- Technical problems and issues
- Interdependencies b/n design and construction methods

Typical technical review program at project start-up
- System requirements review
- System design review
- Preliminary design review

Typically, project reviews become more technical over time
Project Reviews at Management Level

Focus on overall practices and process

- Communication Channels
- Information Coordination
- Teamwork Effectiveness
- Client Relationships
- Supervision Efficiency
- Reliability
- Contract Management
- Learning Programs

- Overall and general (not specific) levels attained for the performance measures
  - Cost
  - Quality
  - Safety
  - Performance
Technical vs. Managerial Reviews

Peña-Mora, et. al., 2003
Output-Oriented vs. Process-Oriented Reviews

- **Work output-oriented reviews**
  - Seek to identify issues with completed work
  - Primarily focused on shorter-term issues

- **Process-oriented reviews**
  - Seek to identify problems with processes
  - Tend to be focused on longer-term
  - Can recourse to higher-order reviews

- Reviews could be comprised of both
Project Reviews by Peers

- An alternative to Project Review by Internal personnel
- Informal review conducted among specialists in the same field, focused on a particular project aspect
- Focus is on work rather than project team

Benefits:
- Early Discovery of Mistakes and Reduction of Rework
- Avoidance of Similar Pitfalls in the Future
- Enhancement of Team Spirit
- Promotion of Learning

- Documentation Limited to Memos and Duration not Exceeding 30 to 60 Minutes
Project Review by Inspection

- Inspection viewed as one form of *formal technical reviews*

- A formal review: technical or managerial personnel analyses of the quality of
  - an original piece of work product
  - the process itself

- Inspection in construction: substantial completion, final completion, ...

- Importance of documentation and formalism to foster feedback and diffusion of learned lessons
Project Review – What form does it take?

Major Forms of Overall Project Reviews:

- Value Engineering Review
- Constructability Walkthroughs
- Substantial Completion Inspection
- Final completion inspection

Each of these forms may involve one of more review tools previously discussed
Forms of Major Project Reviews I – Value Engineering

Value engineering is the process of:
- Identifying and quantifying the performance of various systems in the design of a facility;
- Evaluating the costs and benefits of alternative solutions that achieve similar or better performance for the same or lower costs.

Reviews are necessary for two reasons:
- Need of extensive communication and collaboration
- Uncertainty in the construction industry
### Design Essentials
- Dimensions of Elements (e.g., beams, columns, structural steel etc.)
- Distances between elements (e.g., spans, story heights etc.)
- Changes in dimensions and distances between floors
- Repetition and modularity of dimensions and distances
- Constructability of details (e.g., distances between re-bars)
- Formwork considerations (e.g., availability, size and wasted material)
- Variations in soil and foundation conditions
- Landscaping
- Structural and architectural details (e.g., steel connections)
- Alternative solutions of similar performance but better economies
- Maintainability of the structure

### Construction Methods
- Aggressive environment & weather condition effects
- Loads & deflections during construction
- Electrical and hydraulic conduit locations
- Large equipment accessibility and topography
- Availability of utilities
- Existing infrastructure and societal requirements during construction
- Compatibility of the location with the construction strategy
- Simultaneous co-location of construction teams (and interference)
- Skills availability

### Design Deliverables
- Lack of references
- Lack of details
- Conflicting details
- Ambiguous or conflicting specifications
- Poor quality construction drawings
- Conflicting construction and shop drawings

### Administrative
- Standardization of contracts
- Contract language
- Incomplete or changing specifications and requirements
- Availability of qualified construction inspectors or site engineers
- Communication of the design rationale
- Communication of critical components and issues
Forms of Overall Project Reviews III – Substantial Completion Inspection

- Is a formal inspection that follows the contractor’s request and a subsequent number of walkthroughs towards the end of the works.

- The project manager, the owner, the engineer and the architect inspect the (almost) completed project, and decide whether it is suitable for “occupancy for its intended purpose.”

- The SCI is a formal, contractually prescribed review, with important legal significance.

- Often serves as trigger for release of retainage

- Sometimes followed by final completion inspection
Summary
Approaches, Functions, and Forms for Project Review

- **Approaches for Project Reviews**: In form, formality and functionality, these range from informal peer reviews to contractually prescribed inspections with legal significance.

- **Key functions of Project Review**: (1) Where has project reached and how/when, (2) quality assurance, and (3) knowledge transfer and learning.

- **Forms of Project Review** established by the construction industry: Value engineering reviews, Constructability walkthroughs and Substantial completion inspections.
**Project Audits – What are they?**

**Definition:** A thorough examination of the management of a project (methodology and procedures, records, properties, budgets and expenditures, and degree of completion. *Meredith and Mantel, 2006*)

**Difference:**

- **Project Review:** What problems are there? *When* did they occur? *How* severe?
- **Project Audit:** Detailed form of Project Review

Audits are the most formal and comprehensive form of project review.

- Goal here is to understand *why* project is in its current state.
- Project audits may be for the entire project or only for parts thereof.
- Project audits present the best opportunity for formal learning.
Contents of a Project Audit

- **Current status of the overall project:** Why work actually completed does or does not match the planned level of completion?

- **Future status:** Likelihood of any changes in schedules, cash flows, etc. Why?

- **Status of critical activities:** Why the current and predicted status of tasks could make or break the project

- A critical **examination of project management issues** at all management levels
Contents of a Project Audit (cont’d)

- **Risk assessment and analysis**: What is the potential for project failure or monetary loss?

- **Lessons learned** from (or to) other similar projects

- **Assumptions, limitations and quality of data** used in the audit

- **Comments and conclusions** by the author of the audit
Who Needs the Audit?

- The project manager, who seeks unbiased and comprehensive information from groups or individuals within the project organization.
- The organization, which seeks to identify the errors made, track their causes, and learn not to repeat them.
- The client, who can relate the value of project development to their own actions and decisions.
- Any external stakeholders or sponsors of the project; financial institutions, government agencies, consumer groups, environmental or religious organizations and social groups.
# Financial, Management and Project Audits

**Meredith J. & Mantel S., 2000**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FINANCIAL AUDIT</th>
<th>MANAGEMENT AUDIT</th>
<th>PROJECT AUDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Compares the current status of the business to the accepted standard (ex. Industry, competitors)</strong></td>
<td><strong>Compares the current organizational breakdown structure and culture, to the competition and standards.</strong></td>
<td><strong>Compares the actual status of the project to the planned one.</strong></td>
</tr>
<tr>
<td>PREDICTIONS</td>
<td><strong>The company’s state related to economical growth</strong></td>
<td><strong>The company’s management culture related to future market needs.</strong></td>
<td><strong>The future status of the project including deviations from schedule, cost, quality, natural and socio-political environment.</strong></td>
</tr>
<tr>
<td>MEASUREMENT CRITERIA</td>
<td><strong>Finance-accounting methods/terms</strong></td>
<td><strong>Benchmarking, Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis, market analysis, statistical information</strong></td>
<td><strong>Financial terms, schedule progress, resource utilization, quality-goals established by the contract.</strong></td>
</tr>
<tr>
<td>RECORD KEEPING SYSTEM</td>
<td><strong>Standard finance-accounting format established by legal criteria and professional standards.</strong></td>
<td><strong>No standard system, uses records available in the company or from analyses, produces report.</strong></td>
<td><strong>No standard record-keeping system, uses the one established by the contract, company, or general applied practices.</strong></td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td><strong>Few or none depending on the management system</strong></td>
<td><strong>Many, depending on the results of the research and the objectives of the audit.</strong></td>
<td><strong>Usually covers management issues and risk mitigation.</strong></td>
</tr>
<tr>
<td>QUALIFICATIONS</td>
<td><strong>Professionally and legally qualified auditors</strong></td>
<td><strong>Management consulting firms usually undertake such audits, with experienced and qualified personnel.</strong></td>
<td><strong>Sometimes, lack of technical expertise auditors, lack of funds and time for audit.</strong></td>
</tr>
</tbody>
</table>
Focus on Project Auditing – Scopes

<table>
<thead>
<tr>
<th></th>
<th>General Audit (overview)</th>
<th>Detailed (administrative) Audit</th>
<th>Technical Audit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td>General overview prescribed in contractual arrangements.</td>
<td>Includes the general overview, focuses and elaborates on administrative issues in greater depth.</td>
<td>A focused and detailed investigation into technical issues that present learning opportunities or problems</td>
</tr>
<tr>
<td><strong>When</strong></td>
<td>After Milestones</td>
<td>After Milestones, on demand, according to need.</td>
<td>Usually early in project development, or in post-mortem evaluations</td>
</tr>
<tr>
<td><strong>Who</strong></td>
<td>Internal Auditing Department</td>
<td>Internal auditing department, external consultants</td>
<td>Technically qualified personnel, external experts.</td>
</tr>
<tr>
<td><strong>How</strong></td>
<td>Under schedule and cost constrains</td>
<td>In context of the project ecosystem</td>
<td>So that they provide technical knowledge for the future.</td>
</tr>
</tbody>
</table>

*Peña-Mora et al., 2003*
Causal Relationships examined in a Project Audit

What is affecting What?
Causal Relationships examined in a Project Audit

Causal Relationships and the Dynamic Interaction between ...
- Schedule – Cost – Quality
- Staff Experience & Skill – Quality – Productivity
- Project Requirements – Organization Culture
- Stakeholders – Value Perception – Value Delivery
- Schedule, Cost and Quality – Strategic and Tactical Decisions
- Product-Specific Requirements – Work Breakdown Structure, Organizational Breakdown Structure, Product Development Model
- Information Flow & Record-keeping – Work Breakdown Structure, Organizational Breakdown Structure
- Monitoring Configuration – Corrective Actions – Time Delays – Ultimate Effects
- Resource Planning – Cost – Schedule – Performance
- Hiring Policy – Cost – Quality – Performance
- Financial Strategy – Explicit and Implicit Constraints Imposed – Strategic and Tactical Decisions
Project Audit Essentials

It is essential that a project audit ...

Succeeds in serving as a Learning Tool that consists of Two Separate Processes:
- Generation of the Lesson
- Adoption of the Lessons by the Organization or Project Team

Consists of some key ingredients such as:
- An effective Audit Team
- Unfettered Access to Project Records
- Communication With Project Personnel and Others
- Ability of Audit Team to investigate Exogenous Causes of Project problems
- The Audit Should be Truthful and Honest
- Auditing Performance of Project Personnel
- Audit Report Distribution
The Need for Communication With Personnel during an Audit

- Free flow of information from project personnel to audit team

- Two reasons for communication problems:
  - Unavailability of certain personnel
  - Distrust towards the audit team

- Personnel mental and psychological training to audits (pre-announced scheduling can help!)

- Compromise between friendliness and professionalism of the audit team
Auditing the Performance of Project Personnel

Evaluation of Personnel Performance
Productivity, creativity, commitment, quality, response to unplanned situations, leadership, teamwork, adoptability to the project and organizational culture and relationships with other personnel.

Evaluation Often Viewed As criticism and threat to the Profession

Solution:
- Focus on Situations, Not Individuals
- Personnel Performance Taking Into Account the Organizational Structure and the Culture of the Organization
Audit Report Distribution

- Selective report distribution
- Importance of defining a distribution list for the report early in the life-cycle of the audit
- Comprehensibility of the report to all the addressees
- Implementation of information technology in report distribution
Phases of a Typical Project Audit

Initiation
Planning
Execution
Reporting and Release
Phase 1: Initiation

- Setting of the Pursued Goals
- Formal Determination of Audit Scope: length, formality, the recipient list and the parameters of the project

Tasks Involved:
- Determination of the goals of the audit
- Expert Team Formation.
- Establishing the Purpose and the Scope of the Audit.
- Notification of the Project Team
Phase 2: Planning

Three Major Work Elements:
- Determine the cost, time and technical constraints that do or will govern the auditing effort
- Determine the means and methods to be used in the audit
- Agreeing on a performance baseline

This Step Includes:
- Building the questionnaires, the checklists and the data gathering forms
- Planning an interview schedule
Phase 3: Audit Execution

Investigation Starts With Data Collection

Investigation Follows With Data Analysis and Investigation, Focusing On:
- Assessment of the Project Organization, Management, Methods and Controls
- Statement of both Current and Former Status
- Preliminary Statement of Forecasted Project Status
- Working Quality Assessment
- Delivered Quality Assessment
- Lessons Learned – Action Plan

Audit Execution Followed by Self-Scrutiny Review
Phase 4: Report Preparation and Release

- Audit Report should conform to the audit requirements and needs
- Report should be released according to the distribution plan
- Importance of planning the logistics of report preparation and release
- The policies for conducting and distributing the report:
  - balancing political correctness
  - ease of assimilation of the lessons
  - truthfulness
  - brevity.
Phase 5: Finishing up the Project Audit

Three Essential Steps:

- Audit **Database and Document Filing** by audit service management division
- **Post-Audit Consulting**: the last chance for the project team to discuss with and learn from the auditors
- **Audit Program Evaluation**. The effectiveness, quality, sophistication and depth of the audit are examined.
  - the problems the audit team encountered during their job are also listed
Project Audit Report

A formal document presenting all the work done and the conclusions reached

Table of Contents for a Typical Audit Report:
- Introduction: Project and Audit Scope, Objectives and Circumstances
- Current Project Status: entire project ecosystem
- Future Projection
- Recommendations about changes in technical approach, budget and schedule for the remaining tasks
- Risk Assessment and Analysis:
- Limitations and Assumptions of the Audit: listing of Time, depth, lost records, negative attitudes, focus in specific directions, assumptions and poor inputs
Project Audits - Summary

- Use Project Audits to reveal the interactions between elements in the project ecosystem and their effects on the project.
- Also to investigate the project (or a part of it). In doing so, they must be honest and objective. Only then will they be useful.
- Plan audits carefully: Establish a baseline for comparison, but be open to in-depth investigation if necessary. If the project is long or complex, plan the Audit as a continuous learning processes.
- Make audits worthwhile: Introduce the auditing procedure as an integral part of the product development process. Teach people to appreciate it and learn from it. It works for them, not against them.
Questions?