MCS4204 Software Project Management
Comprehensive Study Notes

Topics 6, 7, 9, 10 - Quality Management, Communication, Procurement & Risk Management

Topic 6: Project Quality Management

Key Quality Management Concepts

- **Quality vs. Grade:** Quality = degree to which characteristics fulfill requirements; Grade = category/rank of same functional use
- **Prevention over Inspection:** Cost of preventing mistakes < cost of correcting mistakes
- **Continuous Improvement:** Plan-Do-Check-Act (PDCA) cycle
- **Management Responsibility:** Success requires management participation

Quality Management Processes

1. **Plan Quality Management:** Identify quality requirements and standards for project and deliverables
2. **Manage Quality:** Execute quality management plan to ensure quality requirements are met
3. **Control Quality:** Monitor and record results of quality activities to assess performance

Cost of Quality (COQ) Framework

```
Total Cost of Quality = Cost of Conformance + Cost of Non-Conformance

Cost of Conformance = Prevention Costs + Appraisal Costs
Cost of Non-Conformance = Internal Failure Costs + External Failure Costs
```

Example: COQ Calculation

Prevention Costs: Training ($10k), Quality planning ($5k) = $15k

Appraisal Costs: Testing ($20k), Inspections ($8k) = $28k

Internal Failure: Rework ($12k), Debugging ($8k) = $20k

External Failure: Customer complaints ($30k), Warranty ($15k) = $45k

Total COQ = $15k + $28k + $20k + $45k = $108k

Seven Basic Quality Tools

1. Cause-and-Effect Diagram

Shows potential causes of problems (Fishbone/Ishikawa diagram)

2. Histogram

Bar chart showing distribution of variables

3. Pareto Chart

80/20 rule - histogram ordered by frequency

4. Scatter Diagram

Shows relationship between two variables

5. Flowchart

Shows process steps and decision points

6. Control Chart

Determines process stability over time

Control Chart Formulas

```
Upper Control Limit (UCL) = Process Mean + 3 × Standard Deviation
Lower Control Limit (LCL) = Process Mean - 3 × Standard Deviation
Center Line (CL) = Process Mean

Where: Process Mean = average of all measurements, Standard Deviation =
measure of variability
```

Design for Excellence (DfX)

- **Design for Manufacturing (DfM):** Optimize for production efficiency
- **Design for Assembly (DfA):** Minimize assembly time and cost
- **Design for Service (DfS):** Enable easy maintenance and support
- **Design for Six Sigma (DfSS):** Build quality into design phase

Topic 7: Project Communication Management

Communication Management Processes

1. **Plan Communications Management:** Develop appropriate approach and plan
2. **Manage Communications:** Ensure timely and appropriate information collection, creation, distribution
3. **Monitor Communications:** Ensure information needs are met

Communication Dimensions

- **Internal:** Within project (team members, stakeholders)
- **External:** Outside project (customers, vendors, public)
- **Formal:** Reports, memos, briefings, presentations
- **Informal:** Emails, ad-hoc discussions, social media
- **Hierarchical:** Up (senior management), Down (subordinates), Lateral (peers)

Communication Methods

Method	Description	Use When
Interactive	Real-time, multidirectional exchange	Meetings, phone calls, instant messaging
Push	Information sent to specific recipients	Letters, memos, reports, emails, faxes
Pull	Recipients access information at their discretion	Intranet sites, e-learning, knowledge repositories

Communication Channels Formula

```
Number of Communication Channels = n(n-1)/2

Where: n = number of people in the project
```

Example: Communication Channels

Project team has 8 members:

Channels = 8(8-1)/2 = 8×7/2 = 28 communication channels

If 2 more people join: 10(10-1)/2 = 45 channels (17 additional channels)

5 Cs of Written Communication

1. **Correct:** Grammar and facts
2. **Concise:** To the point, no unnecessary words
3. **Clear:** Easy to understand, unambiguous
4. **Coherent:** Logical flow of ideas
5. **Courteous:** Polite and considerate tone

Meeting Management Guidelines

1. **Before Meeting:** Prepare agenda, invite right people, set clear objectives
2. **During Meeting:** Start on time, stick to agenda, manage participation, record decisions
3. **After Meeting:** Distribute minutes, track action items, follow up

Topic 9: Project Procurement Management

Procurement Management Processes

1. **Plan Procurement Management:** Document procurement decisions, specify approach, identify potential sellers
2. **Conduct Procurements:** Obtain seller responses, select seller, award contract
3. **Control Procurements:** Manage relationships, monitor performance, make changes, close contracts

Contract Types

1. Fixed-Price Contracts

Type	Description	Risk
Firm Fixed Price (FFP)	Fixed price, no changes unless scope changes	Seller bears cost risk
Fixed Price Incentive Fee (FPIF)	Fixed price with incentives for performance	Shared risk with incentives
Fixed Price Economic Adjustment (FPEPA)	Fixed price with predefined adjustments for inflation/currency	Seller protected from economic changes

FPIF Calculation Formulas

```
If Actual Cost ≤ Target Cost (Underrun):
Adjusted Profit = Target Profit + ((Target Cost - Actual Cost) × Seller Share Ratio)

If Actual Cost > Target Cost (Overrun):
Adjusted Profit = Target Profit - ((Actual Cost - Target Cost) × Seller Share Ratio)

Final Price = Actual Cost + Adjusted Profit
Final Price cannot exceed Ceiling Price
```

Example: FPIF Contract Calculation

Given: Target Cost = $200K, Target Profit = $40K, Target Price = $240K

Ceiling Price = $270K, Share Ratio = 70/30 (Buyer/Seller)

Scenario 1 - Actual Cost = $210K (Overrun):

Overrun = $210K - $200K = $10K

Seller's penalty = 30% × $10K = $3K

Adjusted Profit = $40K - $3K = $37K

Final Price = $210K + $37K = $247K

Scenario 2 - Actual Cost = $190K (Underrun):

Underrun = $200K - $190K = $10K

Seller's bonus = 30% × $10K = $3K

Adjusted Profit = $40K + $3K = $43K

Final Price = $190K + $43K = $233K

2. Cost-Reimbursable Contracts

Type	Description	Risk
Cost Plus Fixed Fee (CPFF)	Reimburse costs + fixed fee (% of initial estimate)	Buyer bears cost risk
Cost Plus Incentive Fee (CPIF)	Reimburse costs + incentive fee based on performance	Shared cost risk
Cost Plus Award Fee (CPAF)	Reimburse costs + subjective award fee	Buyer bears cost risk

CPIF Calculation Formula

```
Final Incentive Fee = Target Fee + ((Target Cost - Actual Cost) × Seller Share Ratio)

Final Fee must be between Minimum Fee and Maximum Fee
Final Price = Actual Cost + Final Incentive Fee
```

Example: CPIF Contract

Given: Target Cost = $100K, Target Fee = $12K, Share Ratio = 80/20

Max Fee = $15K, Min Fee = $10K, Actual Cost = $80K

Final Fee = $12K + (($100K - $80K) × 20%) = $12K + $4K = $16K

Since $16K > $15K (max), Final Fee = $15K

Total Payment = $80K + $15K = $95K

3. Time and Materials (T&M) Contracts

- Hybrid contract with aspects of both fixed-price and cost-reimbursable
- Used for staff augmentation, expert acquisition
- Example: $1K per day plus expenses
- Risk increases with contract duration

Source Selection Methods

Method	When to Use	Selection Criteria
Least Cost	Standard/routine procurements	Lowest price
Qualifications Only	Small procurement value	Best qualifications/experience
Quality-Based	Technical expertise critical	Highest technical score
Quality and Cost-Based	Balance quality and cost	Best value (quality + cost)
Sole Source	Single qualified seller	No competition
Fixed Budget	Budget cannot be exceeded	Best solution within budget

Topic 10: Project Risk Management

Risk Management Processes

1. **Plan Risk Management:** Define approach, methodology, roles, responsibilities
2. **Identify Risks:** Determine which risks may affect project
3. **Perform Qualitative Risk Analysis:** Prioritize risks by probability and impact
4. **Perform Quantitative Risk Analysis:** Analyze numerically the effect of identified risks
5. **Plan Risk Responses:** Develop options and actions to enhance opportunities and reduce threats
6. **Implement Risk Responses:** Execute agreed-upon risk response plans
7. **Monitor Risks:** Track identified risks, monitor residual risks, identify new risks

Risk Categories (RBS)

- **Technical:** Technology appropriateness, complexity, interfaces
- **External:** Regulatory changes, market conditions, weather
- **Organizational:** Resource availability, funding, prioritization
- **Project Management:** Planning, controlling, communication, estimation

Risk Analysis Methods

Qualitative Risk Analysis

Probability	Impact			
	Low	Moderate	Significant	High
High (>50%)	Medium	High	High	High
Significant (30-50%)	Low	Medium	High	High
Moderate (10-29%)	Low	Low	Medium	High
Low (<10%)	Low	Low	Low	Medium

Quantitative Risk Analysis

```
Risk Exposure (RE) = Risk Probability × Risk Impact
RE = P(Risk) × Loss(Risk)
```

Example: Risk Exposure Calculation

Data center fire risk: 1 in 1000 chance, $500K impact if occurs

Risk Exposure = (1/1000) × $500K = $500

This represents the minimum insurance premium needed.

Risk Response Strategies

Strategy	Threats (Negative Risks)	Opportunities (Positive Risks)
Accept/Tolerate	Acknowledge risk, no proactive action	Accept opportunity without pursuing
Avoid/Terminate	Eliminate risk by removing cause	Ensure opportunity occurs
Mitigate/Treat	Reduce probability or impact	Enhance probability or impact
Transfer	Shift risk to third party (insurance)	Share opportunity with partner

Risk Reduction Leverage

```
Risk Reduction Leverage (RRL) = (RE Before - RE After) / Risk Reduction Cost
```

Example: Risk Reduction Analysis

Original Risk: P=0.8, Impact=45 days delay, RE=36 days

Countermeasure A: Cost=$10K, New P=0.6, Impact=30 days, New RE=18 days

RRL = (36-18)/10K = 18/10K = 0.0018 days/$

Countermeasure B: Cost=$50K, New P=0.3, Impact=7 days, New RE=2.1 days

RRL = (36-2.1)/50K = 33.9/50K = 0.000678 days/$

Countermeasure A is more cost-effective (higher RRL)

PERT (Program Evaluation Review Technique)

```
Expected Duration = (Optimistic + 4×Most Likely + Pessimistic) / 6
Standard Deviation = (Pessimistic - Optimistic) / 6
Variance = (Standard Deviation)²

Where: Optimistic = best case time, Most Likely = realistic time, Pessimistic
= worst case time
```

Project Completion Probability

```
Z-Score = (Target Date - Expected Date) / Project Standard Deviation
Project Standard Deviation = Square Root of (Sum of Critical Path Activity
Variances)
```

Example: PERT Calculation

Activity A: Optimistic=5, Most Likely=6, Pessimistic=8

Expected Duration = (5 + 4×6 + 8)/6 = 37/6 = 6.17 weeks

Standard Deviation = (8-5)/6 = 0.5 weeks

Project Completion Probability:

Target = 15 weeks, Expected = 13.5 weeks, Project Std Dev = 1.22 weeks

Z-Score = (15-13.5)/1.22 = 1.23

Using normal distribution: Probability of meeting target = 89%, Missing target = 11%

Monte Carlo Simulation

- Uses probability distributions for activity durations
- Performs thousands of iterations to simulate project outcomes
- Provides probability distribution of project completion times
- More accurate than PERT for complex projects

Summary Formulas Quick Reference

```
Quality: Cost of Quality = Prevention + Appraisal + Internal Failure + External Failure
Communication: Channels = Number of People × (Number of People - 1) / 2
FPIF: Final Price = Actual Cost + (Target Profit ± Share of Over/Underrun)
CPIF: Final Fee = Target Fee + ((Target Cost - Actual Cost) × Seller Share)
Risk: Risk Exposure = Probability × Impact
RRL: (Risk Exposure Before - Risk Exposure After) / Reduction Cost
PERT: Expected Duration = (Optimistic + 4×Most Likely + Pessimistic)/6
PERT: Standard Deviation = (Pessimistic - Optimistic)/6
Z-Score: (Target Date - Expected Date) / Standard Deviation
```

End of Study Notes - Good Luck with Your Exam!