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APPENDICES

APPENDIX A.

RISK ESTIMATION RESULT

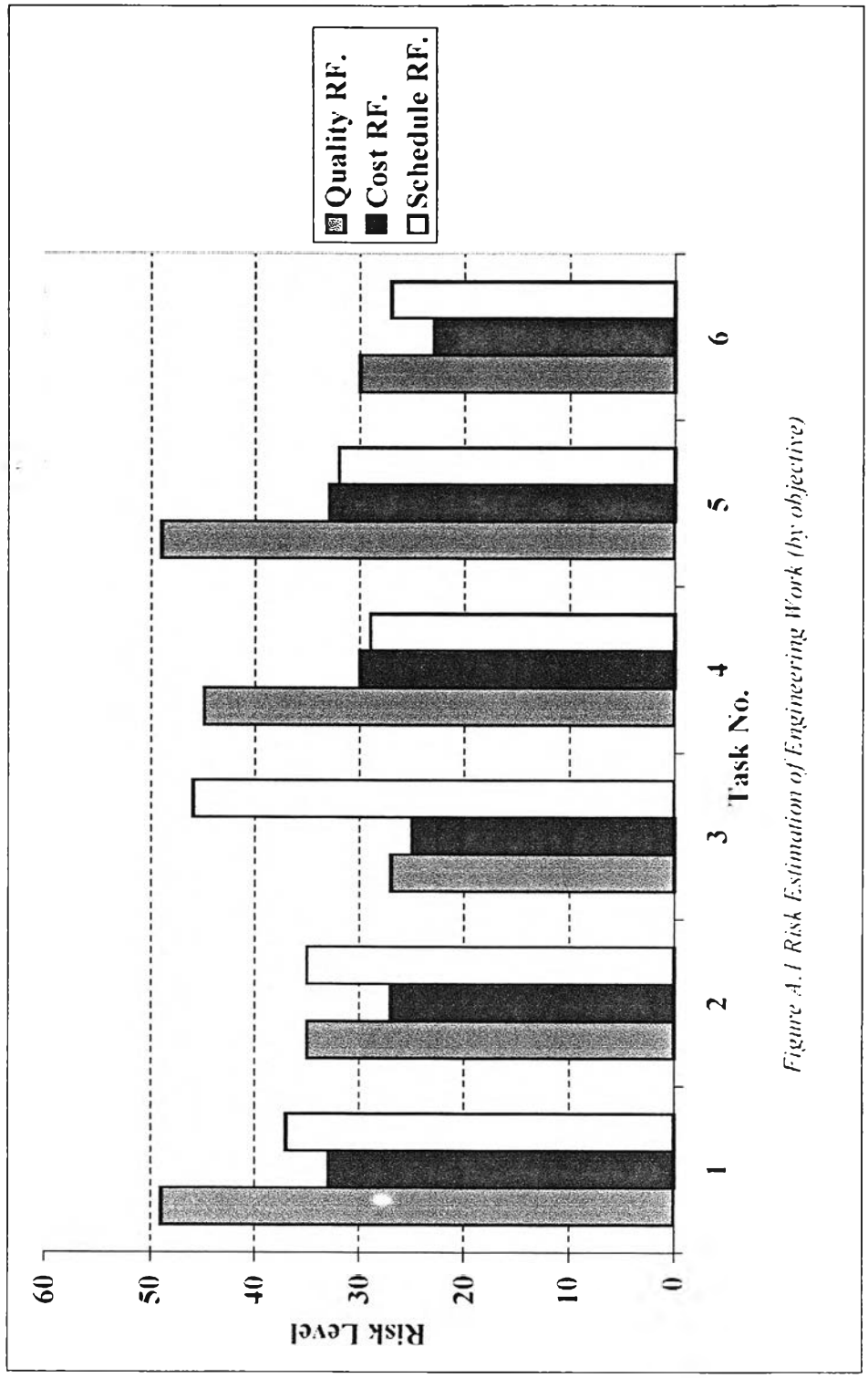

Figure A.1 Risk Estimation of Engineering Work (by objective)

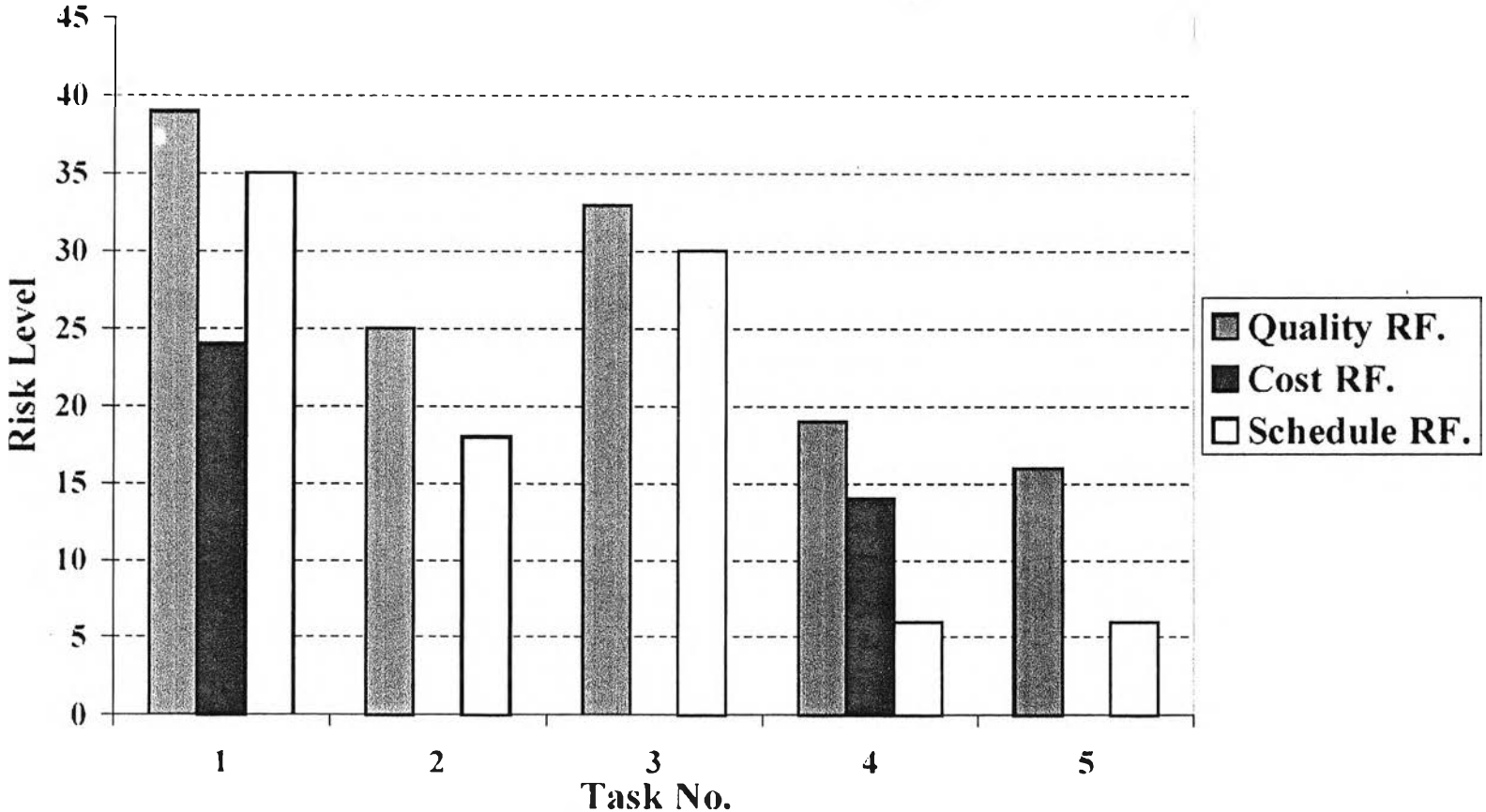

Figure A.2 Risk Estimaiton of Procurement Work (by objective)

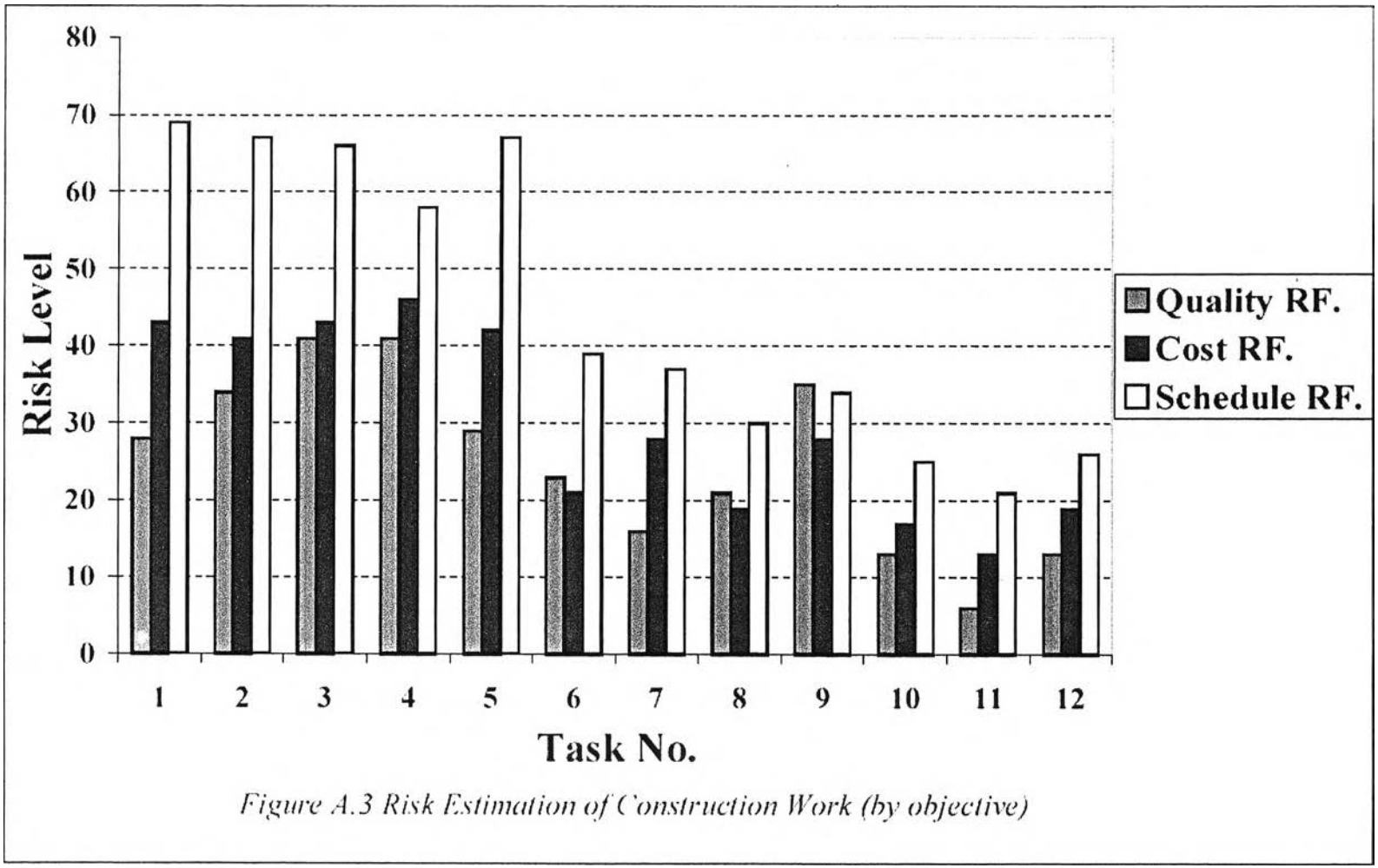

Figure A.3 Risk Estimation of Construction Work (by objective)

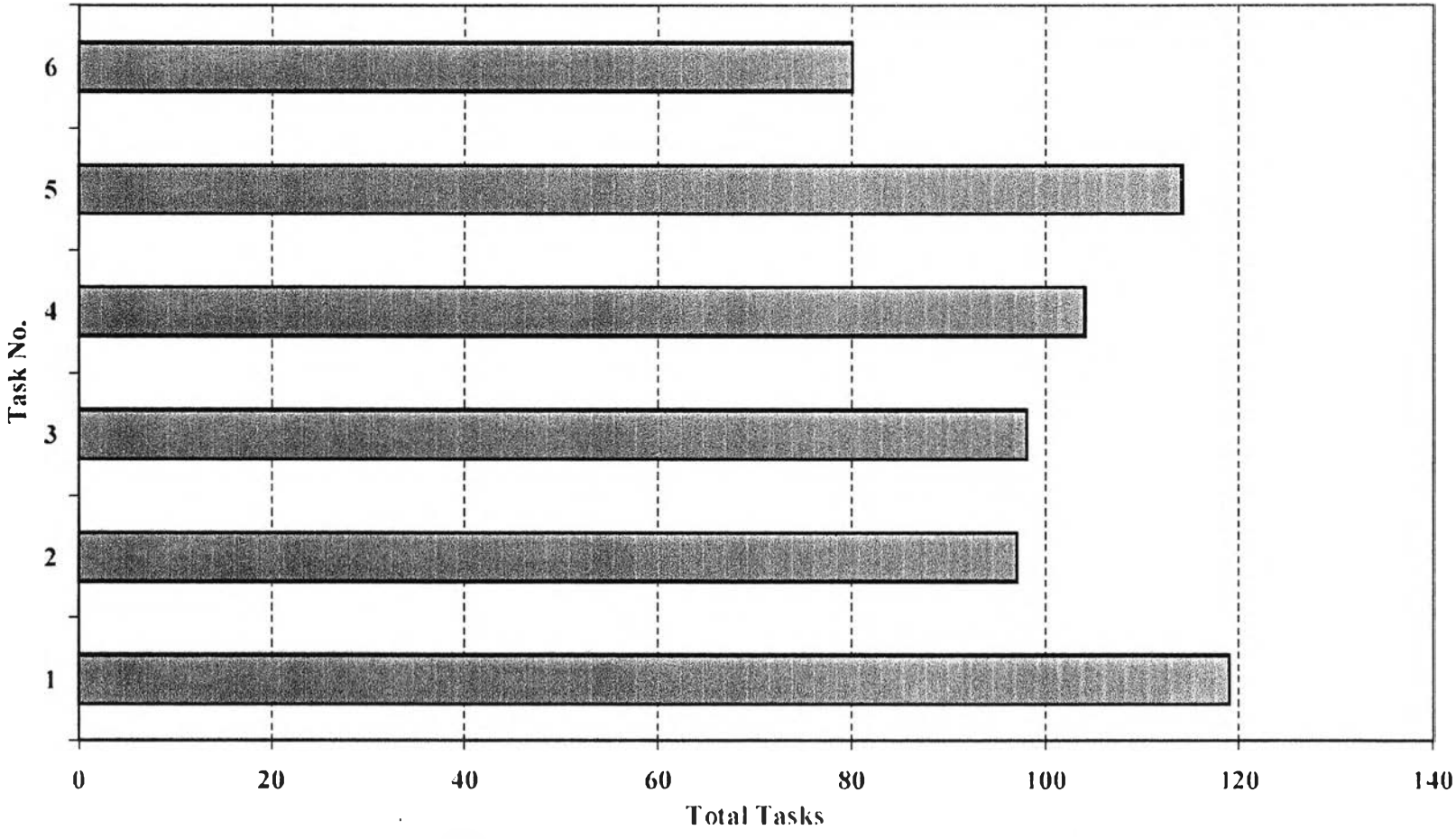

Figure A.4 Risk Estimation of Engineering Work (by task)

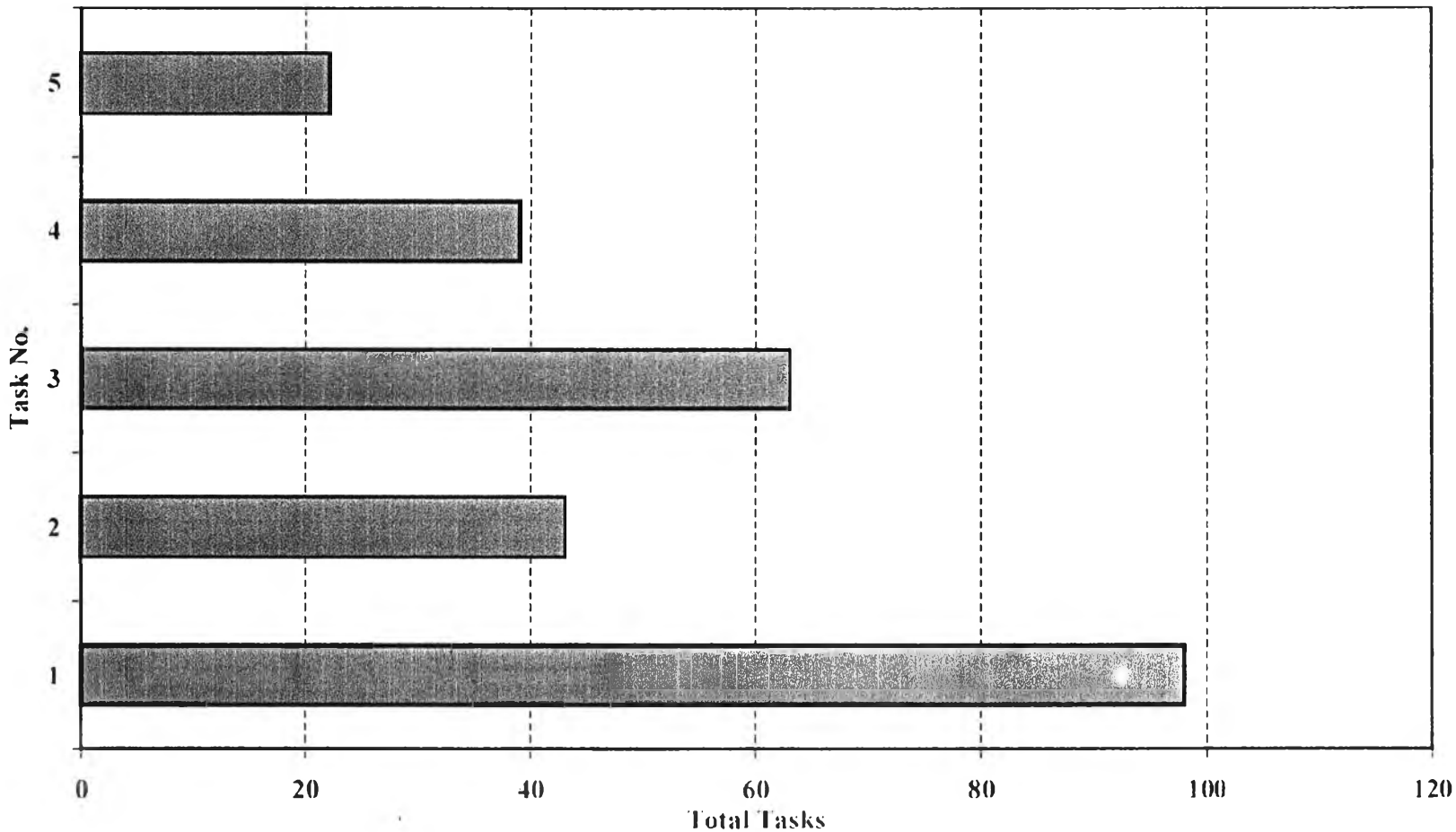

Figure A.5 Risk Estimation of Procurement Work (by task)

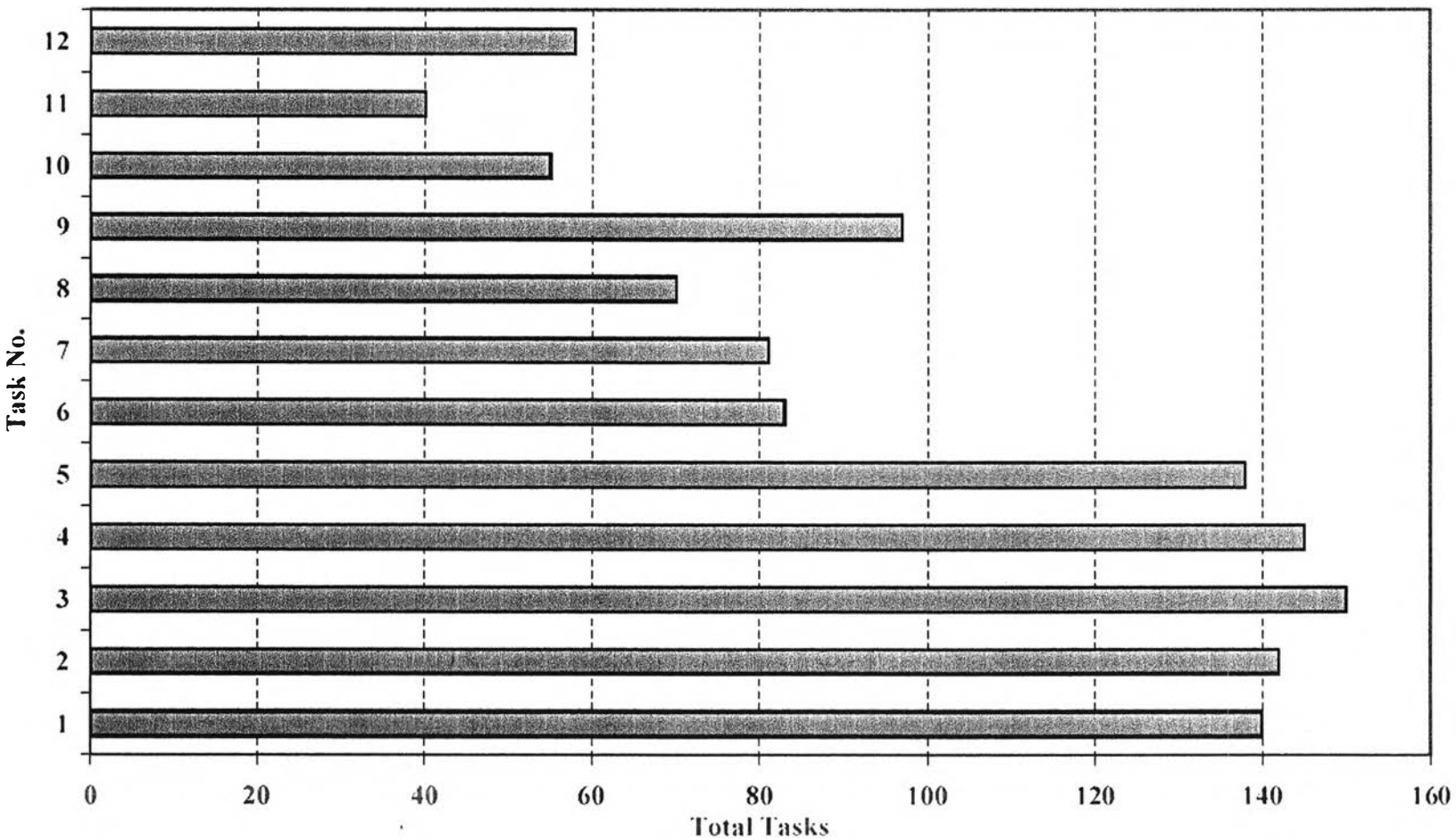

Figure A.6 Risk Estimation of Construction Work (by task)

APPENDIX B.
RISK MANAGEMENT CHECKLIST

In order to ensure that risk management will be totally considered for all processes, checklist for risk management would be applied.

Initiation

- ☐ Assemble risk management resources
- ☐ Appoint the team leader and ensure a breadth of skills/experience within the team
- ☐ Assign risk management responsibilities appropriate to task

1. Proposal familiarization: Specify objectives and criteria

- ☐ Familiarize the team with the proposal, assemble documentation and define the key objectives
- ☐ Assess the proposal in relation to the Agency's objectives and strategies
- ☐ Determine assessment criteria for proposal

Define key elements

- ☐ Define key elements (target 20-50 elements, items or activities) to structure risk analysis

2. Risk analysis: Identify risks

- ☐ Prepare a comprehensive schedule of risks for each element
- ☐ Describe each risk and list the main assumptions

Assess risk likelihoods and consequences

- ☐ Assemble data on risk and their consequences
- ☐ Assess risk likelihoods
- ☐ Assess risk impacts

Identify significant risks

☐ Rank risks to reflect impacts and likelihoods

☐ Where applicable, estimate risk factors

☐ Discard/accept minor risks

☐ Identify moderate risks for management measures

☐ Identify major risks for detailed risk action planning

3. Risk response planning: Identify feasible responses

☐ For each moderate and major risk, identify the feasible responses

☐ Responses may include:

- Risk prevention
- Impact mitigation
- Risk transfer and insurance
- Risk acceptance

☐ Describe each feasible response and list main assumptions

Select the best response

☐ Evaluate the benefits and costs for each response

☐ Select the preferred response

Develop management measures and action schedules

☐ Specify risk management measures for moderate risks

☐ Develop risk action schedules for major risks

- Actions required (what is to be done?)
- Resources (what and who?)
- Responsibilities (who?)
- Timing (when?)

4. Reporting

- ☐ For designated proposals, produce the Risk Management Plan
- ☐ For other projects, collate and summarize risk action schedules and measures

5. Risk management implementation

- ☐ Implement measures and action strategies
- ☐ Monitor the implementation
  - Assign responsibilities
  - Timing
- ☐ Undertake periodic review and performance evaluation

Source: New South Wales. Government Asset Management Committee (2001)

APPENDIX C.

PROJECT MANAGEMENT SCALABLE METHODOLOGY GUIDE

	Priority			
Area	4 *Quality goals easily understood, achieved, and monitored.*	3 *Quality goals can be defined and measured using existing systems and methods; quality risk low.*	2 *Quality goals are extensive, require innovative approaches; and may impact project success.*	1 *Quality goals are difficult to define; hard to measure and achieve; significant risk to project acceptance.*
Quality Assurance Plan	Define quality goals; discuss approach and plans to achieve goals; assess risks to success; discuss adequacy of approach; set high standards.	Document explicit quality goals; define methods and tests to achieve, control, predict and verify success; focus on customer satisfaction.	Document QA goals, plans, methods, and systems; consider *ilities* in quality goals; focus processes on minimizing correction costs.	Document QA plan including quantitative goals, statement of methods to achieve, quality metrics, controls and verifications; link QA to stakeholder and risk analysis.
Quality Management	Consider quality management integral to project work; ensure project team understands role in achieving quality goals; have PM maintain visibility of quality issues.	Implement integrated quality management through delegated quality goals; plan work methods, technologies, measurements and controls to achieve goals; build quality into processes and products.	Integrate quality management tasks into project plan; establish quality goals; delegate goals to work groups; report quality metrics and track progress.	Assign quality management oversight in PM staff; monitor metrics and trends to achieve quality goals; integrate quality management into project planning and risk management.
Quality Metrics, Measurements, and Controls	Conduct subjective (qualitative) or objective (quantitative) assessments periodically; monitor and report quality status at periodic project reviews.	Map quality metrics to quality goals, and report periodically; apply standard quality tools to measure, predict and control results.	Establish quality metrics and conduct quality audits to predict and verify achievement of goals and identify need for corrective actions; apply quality control techniques to project effort.	Implement *best practices* quality control organization; document quality methods integral to project plan; provide commitment of staff, tools, and methods to support quality effort.
Continuous Quality Improvement	Communicate continually a project goal to work smarter and find better processes; plan the project to accommodate future improvements.	Review the project approach and design concept for modularity, expandability and growth; consider CQI in product life cycle strategy.	Include CQI tasks in project plans and budget; establish CQI goals and metrics, and report progress periodically.	Incorporate CQI/TQM goals into specifications and plans; review project methods for improvement opportunities; institutionalize CQI processes and incorporate provisions into product design.

Table C.1 Project Quality Management

Source: Chapman, James R. (1997)

Area	Priority			
	4 *Minor investment, level of effort tasks, within current budgets, cost risk considered low.*	*3* *Moderate investment, varied cost accounts, project budgeted separately, some cost risk.*	*2* *Significant investment, costs from different sources, capital budget item, significant technical and cost unknowns.*	*1* *Major investment, diverse expenditures, substantial visibility, substantial technical and cost risks.*
Cost Estimating	Apply management judgment to estimate and justify costs; base cost authorization on staffing commitments; make general cost target to monitor spending.	Prepare written cost estimate; document data sources and estimating assumptions; validate estimate by analogy and using historical data.	Prepare formal cost estimate, with documented assumptions, using a consistent methodology, and historical data; require approval by experienced estimator.	Prepare cost estimates at the work package level; use modeling, sensitivity analysis and identification of cost risks; obtain independent cost assessment; produce auditable backup package.
Budgeting	Establish ball-park estimates of time-phased budget goals; track staff usage against plan to assess project spending.	Allocate budgets by groups within the project, establish project level spend plan and track and report actuals.	Budgets allocated by group or WBS element; preparation of multiple spend plans; groups track and report spending.	Rollup or allocate project budgets by WBS element; cost account managers commit to costs; collect data at the work package level; establish time phased budget baseline at the cost account level.
Cost and Schedule Control System	Prepare periodic guesstimates of percent accomplished and percent spent compared to progress and spending plans; report cost and schedule variances and performance indexes at WBS level 1.	Maintain traceable planning baselines to facilitate cost and schedule tracking; collect earned value and actual spending data to calculate variances and indexes at WBS level 1.	Establish time-phased budgets at WBS level 2; maintain traceable baselines and collect data to report variances and indexes at level 2; adapt accounting systems to provide reliable, and timely information.	Document systems and procedures for cost and schedule control; compute variances at WBS level 3; apply earned value *implementation guide criteria* to determine system adequacy.
Cost Analysis	Prepare cost estimates informally; justify project approval on rough assessment of cost reasonableness, affordability and benefits.	Prepare written cost estimates using available data, judgment and analogy; apply ball-park estimates to project changes and decision points; identify cost drivers.	Apply documented and systematic approaches to cost impacts of project decisions; review estimates and conduct sensitivity analysis on major assumptions.	Prepare documented costs estimates for changes; maintain auditable files of backup assumptions, data, and methodologies; use a standard WBS to build historical cost database for future estimates.

Table C.2 Project Cost Management

Source: Chapman, James R. (1997)

Area	Priority 4 *Informal schedule goals, simple dependencies, low management interest, familiar project tasks.*	3 *Definite schedule goal, numerous dependencies, some project visibility, some unknowns.*	2 *Important schedule goal, significant dependencies, high project visibility, moderate unknowns.*	1 *Critical schedule goal, complex dependencies, high interest project, significant unknowns.*
Project Schedules	Establish project target date with immediate milestones, prepare project Gantt schedule and circulate to team members; obtain team buy-in on project schedule goals.	Prepare top-level Gantt schedule and sub-team rollups; identify major and intermediate milestones; scrutinize dependencies; maintain baseline stability between major milestones or formal replans.	Publish schedules and keep updates visible; maintain schedule baseline discipline and traceability; document milestone exit criteria; report and track schedule variances and performance indexes.	Use comprehensive automated scheduling system; document procedures for schedule baseline management and data collection; swarm problem areas with micro-schedules and daily status meetings.
Schedule Estimating	Estimate schedule durations based on judgment, staff-months, and duration analogies to previous work; identify schedule dependencies, assess schedule risk areas.	Document schedule estimates based on historical data and estimates of work and staffing; keep work packages smaller than two weeks; assess schedule risk and apply contingencies.	Document schedule assumptions and estimating methodology; evaluate and elevate schedule uncertainties; obtain independent expert assessment of schedule realism.	Use documented schedule estimating methodology; apply historical data, analogies, and expert judgements; obtain team ownership of schedules; quantify risks and apply contingencies.
Critical Path Analysis	Identify critical path identified informally on Gantt schedule; keep team members mindful of critical path; have PM consider ways to shorten critical path.	Identify schedule dependencies and design hand-offs clearly; use a CPM graphic to compute and display the critical path; report status periodically, and look for ways to shorten the path.	Conduct risk assessment along the critical path; manage the critical path to tighten and identify workarounds; rethink dependencies to accelerate overall schedule.	Conduct statistical assessment of schedule risks (PERT); examine opportunities for streamlining, crashing, and concurrencies; watch for near-critical paths and assess risks.
Schedule Tracking	Update project schedules to show actual progress and revisions compared to baseline plan; keep original schedule goals visible until formally replanned by PM.	Collect data for percent completions and planning revisions periodically; report status against traceable schedule baseline; document approaches to assessing earned value.	Track schedule progress against formal baseline for all tasks; identify level of effort tasks; use repeatable procedures for data gathering, earned value assessment, and status reporting.	Document procedures for baseline management, schedule data collection and flow, data analysis and reporting. (see C/SCS in Cost section)

Table C.3 Project Time Management

Source: Chapman, James R. (1997)

APPENDIX D.

S.O.D. of FMEA

Effect	*SEVERITY of Effect*	*Ranking*
Hazardous without warning	Very high severity ranking when a potential failure mode affects safe system operation without warning	10
Hazardous with warning	Very high severity ranking when a potential failure mode affects safe system operation with warning	9
Very High	System inoperable with destructive failure without compromising safety	8
High	System inoperable with equipment damage	7
Moderate	System inoperable with minor damage	6
Low	System inoperable without damage	5
Very Low	System operable with significant degradation of performance	4
Minor	System operable with some degradation of performance	3
Very Minor	System operable with minimal interference	2
None	No effect	1

Table D.1 Severity of Effect

Source: Crow, Kenneth (2002)

PROBABILITY of Failure	***Failure Prob.***	***Ranking***
Very High: Failure is almost inevitable	>1 in 2	10
	1 in 3	9
High: Repeated failures	1 in 8	8
	1 in 20	7
Moderate: Occasional failures	1 in 80	6
	1 in 400	5
	1 in 2,000	4
Low: Relatively few failures	1 in 15,000	3
	1 in 150,000	2
Remote: Failure is unlikely	<1 in 1,500,000	1

Table D.2 Probability of Failure

Source: Crow, Kenneth (2002)

Detection	*Likelihood of DETECTION by Design Control*	*Ranking*
Absolute Uncertainty	Design control cannot detect potential cause/mechanism and subsequent failure mode.	10
Very Remote	Very remote chance the design control will detect potential cause/mechanism and subsequent failure mode.	9
Remote	Remote chance the design control will detect potential cause/mechanism and subsequent failure mode.	8
Very Low	Very low chance the design control will detect potential cause/mechanism and subsequent failure mode.	7
Low	Low chance the design control will detect potential cause/mechanism and subsequent failure mode.	6
Moderate	Moderate chance the design control will detect potential cause/mechanism and subsequent failure mode.	5
Moderately High	Moderately High chance the design control will detect potential cause/mechanism and subsequent failure mode.	4
High	High chance the design control will detect potential cause/mechanism and subsequent failure mode.	3
Very High	Very high chance the design control will detect potential cause/mechanism and subsequent failure mode.	2
Almost Certain	Design control will detect potential cause/mechanism and subsequent failure mode.	1

Table D.3 Likelihood of Detection

Source: Crow, Kenneth (2002)

BIOGRAPHY

Mr. Yeam Deedamrongchai was born in Bangkok in 1978. He earned his bachelor's degree in electrical engineering from Thammasat University in 2000. After graduation, he started working as an electrical engineer in construction company for one year. After that, he decided to study for Master of Engineering and Master of Science in Engineering Management jointly offered by Chulalongkorn University and Warwick at the Regional Centre for Manufacturing Systems Engineering. He was enrolled as a full-time student and graduated in the academic year 2004.