

Index

- Analytic network process (ANP),
 - 1–2, 5–7, 9, 11–12,
 - 47–52, 58, 77–78, 82, 85,
 - 89–90, 92–93, 95, 110,
 - 119, 128, 131, 184, 195,
 - 198, 204, 207, 214, 219,
 - 221, 224, 226–227, 229,
 - 231–232, 255
- consistency test, 52–55
- model structure development,
 - 50–51
- pairwise comparison, 52
- Behaviour mode sensitivity analysis,
 - 260, 274–280
- Big Dig project, 2, 45
- Billfinger Berger and Siemens (BBS),
 - 17, 26, 28
- Billfinger Berger Civil UK Ltd, 16
- Boundary adequacy, 219, 255, 257,
 - 280
- Causality of technical uncertainties,
 - 133, 134
- Causal loop diagram (CLD),
 - 57–58, 131, 165, 284
- economic risks system, 151, 152
- environmental risks system, 155
- political risks system, 160
- social risks system, 141, 142
- STEER risks system, 132
- technical risks system, 145, 147
- Causal tree diagram, 145
- economic risks model, 153
- environmental risks model, 158
- political risks model, 163
- political risks system, 160
- social risks model, 144
- technical risks model, 149
- technical uncertainties, 133, 134
- Completion risks, 67–68
- Computerised model verification,
 - 252
- Conceptual model validation, 252
- Consistency index (CI), 53
 - calculation, 54
- Consistency ratio (CR), 52–53,
 - 119, 123–124
 - calculation, 54
- Consistency test, 52, 54, 119–124,
 - 184
- Cost overrun, 2, 35, 44–45, 145,
 - 157, 168, 198
- Criterion cluster, 51
- Danish Great Belt rail tunnel, 45
- Data validity
 - ETN project, 220
- Decision-making
 - megaproject management, 1–2
- Delays, 43
 - mega construction projects, 44
 - in SD models, 57
 - in the tram works, 29
- Deriving priorities for risks ratings,
 - 120
- Dimensional consistency, 184, 219,
 - 257
- Disaggregation of dynamic
 - simulation models, 282,
 - 283
- Dynamic risks assessment in
 - megaproject, framework
 - for, 225

- Dynamic simulation models,
 - validation of, 216, 250
- Dynamic simulations, 184,
 - 184–216, 250
 - economic risks system model,
 - 203, 206–207, 208–209
 - environmental risks system
 - model, 207, 209–210,
 - 211–212
 - political risks system model, 210,
 - 212, 214–217
 - social risks system model, 196,
 - 197–199, 199, 202
 - technical risks system model,
 - 198, 201, 203, 205–206
- Economic risks, 64, 148, 152, 153,
 - 168, 203
 - completion risks, 67–68
 - market risk, 68
 - in megaprojects, 69
- Economic risks system, 148–154
 - ANP inputs, 195
 - causalities, for stock variables,
 - 153–154
 - causal loop diagram for, 151,
 - 152
 - dynamic simulation results and
 - discussion, 203, 207,
 - 208–209
 - evaluation tests for, 185
 - integrated Stock and Flow
 - Model (SFMs) for, 168
 - mathematical equation, for
 - system variables,
 - 176–178
 - one-way analysis of variance,
 - 217
 - system boundary for, 138
- Economic risk variables
 - pairwise comparison matrix for,
 - 103
 - verbal ratings for, 122
- Edinburgh Tram Network (ETN)
 - project, 1, 15, 16–17, 77,
 - 84, 123, 157, 250
 - basic information of, 18
 - bridges built to accommodate,
 - 27
 - construction and civil
 - engineering works, 17,
 - 25–26, 28
 - contractual disputes, 28, 30–31
 - 1871–1956 era, 15–16
 - environment of, 24
 - external stakeholders of, 21–22
 - impact of bad weather
 - conditions, 36–37
 - internal stakeholders of, 19–20
 - organization of, 23
 - organizations and groups
 - consulted during the
 - EIA for, 34
 - rework and adverse
 - environmental impacts,
 - 35
 - specific risks impacting on
 - project environment,
 - 38–39
 - stakeholder relationship map for,
 - 25
 - stakeholder's attitude and
 - influence on, 23
- STEEP risks, 28
 - economic issues, 39
 - environmental issues, 33–35,
 - 39
 - political issues, 35–40
 - social issues, 28–29, 38
 - technical issues, 29, 32–33,
 - 38–39
- technical risks impacting on
 - social and natural
 - environments, 40
 - traffic diversions, 32–33
 - utility diversions for, 27

- Engineering, procurement and construction (EPC) contract, 67
- Environmental Impact Assessment (EIA), 33
- Environmental Impact Assessment (Scotland) Regulations, 1999, 33
- Environmental Resource Management (ERM), 33
- Environmental risk cluster, 68–70, 92
- Environmental risks in megaprojects, 71
- Environmental risks system, 154–157
 - ANP inputs, 195
 - causalities, for stock variables, 157, 162
 - causal loop diagram for, 155
 - dynamic simulation results and discussion, 207, 209–210, 211–212
 - evaluation tests for, 184
 - integrated SFMs for, 169
 - mathematical equation, for system variables, 179–180
 - one-way analysis of variance, 217
 - system boundary for, 139
- Environmental risk variables
 - pairwise comparison matrix for, 106
 - verbal ratings for, 123
- ‘Everything Goes According to Plan’ (EGAP) principle, 3
- Feedback loop approach, 281–282
- Final mode ANP decision-making priorities
 - economic risks sub-cluster, 116
 - Environmental risk sub-cluster, 117
 - political risk variables, 118
 - potential risks cluster, 113
 - social risk sub-cluster, 114
 - technical risk sub-cluster, 115
- Financial closure, 68
- Ideal priority value (IPV), 93, 95
- Ideal risk priority indexes (IRPIs), 110
- InterCity Express (ICE) project, in Germany, 156
- Likert scale, 119
- Liquidated damages (LDs), 67
- Market risk, 68
- Maximum eigenvalue, calculating, 53
- MegaDS model, 260, 282, 287
- Megaproject
 - Big Dig project, 2, 45
 - Danish Great Belt rail tunnel project, 45
 - economic risks, 64–68, 148–154
 - environmental risks, 68–70, 154–157
 - InterCity Express (ICE) project, 156
 - political risks, 70–74, 157–162
 - problem with megaprojects, 2–6
 - risks, 2–5
 - social risks, 59–61, 141–145
 - technical risks, 61–64, 145–148
 - Train à Grande Vitesse (TGV) project, 156
- Model validation, 250
 - integrated system model
 - objective, importance of, 254
 - integrated system models, methods for testing and validating, 252–254
 - model behaviour, validating, 258

- behaviour mode sensitivity analysis, 260, 274–280
- behaviour reproduction test, 258–259
- disaggregation approach, 282
- feedback approach, 281–282
- manageable model size, 284–287
- numerical sensitivity analysis, 259–260, 263–273
- policy analysis, design and improvement, 280–281
- policy implementation, 287
- sensitivity analysis, 259
- simulation approach, 282–284
- stock and exogenous system entities for STEEP risks models, 261–262
- philosophical aspects of model validity, 250–251
- process, 251–252
- tests of suitability, 255
 - boundary adequacy, 255–257
 - dimensional consistency, 257
 - extreme conditions, 258
 - parameter verification, 255
 - structure verification, 255
- validating the model structure, 254
- Multi-criterion decision-making (MCDM) methodology, 48, 227
- analytic hierarchical process (AHP), 48
- analytic network process (ANP), 48, 227
- criteria, 48, 227
- Multi-Utilities Framework Agreement (MUDFA), 17, 37
- Normalized priority value (NPV), 93, 95
- Numerical sensitivity analysis, 259–260, 263–273
- Operational validation, 252
- Operations and maintenance (O&M) agreement, 68
- Pairwise comparison matrix, 119, 124
 - economic risk variables, 103
 - environmental risk variables, 106
 - political risk variables, 107
 - social risk variables, 98
 - technical risk variables, 100
- Parameter verification, of STEEP models, 219, 255
- Pattern-oriented policy analysis, 281
- Policy analysis, design and improvement, 280–281
- Political risk cluster, 70–74
- Political risks in megaprojects, 75
- Political risks system, 157–162
 - ANP inputs, 195
 - causalities, for stock variables, 162, 163, 164
 - causal loop diagram for, 160
 - dynamic simulation results and discussion, 210, 212–216
 - evaluation tests for, 185–186
 - integrated SFMs for, 170
 - mathematical equation, for system variables, 181–183
 - one-way analysis of variance, 217
 - system boundary for, 140
- Political risk variables
 - final mode ANP decision-making priorities for, 118
 - pairwise comparison matrix for, 107
 - verbal ratings for, 123

- Potential risks, 4–5, 43, 49, 51
 - political risk cluster, 70–74
 - political risk variables, 107, 118, 123, 214
 - political risks in megaprojects, 75
 - political risks system, 140, 157–162, 181, 210
 - unweighted super matrix for, 111
 - verbal ratings for, 120
 - weighted supermatrix for, 112
- Potential risks cluster, 95
 - final mode ANP decision-making priorities for, 113
 - potential risks sub-clusters, 95–109
- Problem with megaprojects, 2
 - megaproject risk assessment, 4–5
 - megaproject risks, 2–3
 - new risk assessment framework, 5–6
- Project financing, 64
- Project manager, 4–5, 56, 61, 63–64, 67, 80, 147, 201, 214, 221, 287
- Project objectives cluster, 93
- Project risk management (PRM) facilities, 5, 8, 231
- Project risks, 5, 68, 74, 80–81
- Project risk systems model, 131–140
 - initial model development, 135–136
 - model causality, 133–135
 - system boundaries, 136–140
- Realistic ‘construction time’, 44
- Respondent’s mean scores of importance (RMSI), 85, 86
 - potential risks, 321–326
 - economic risks, 309–314
 - environmental risks, 315–320
 - social risks, 297–302
 - technical risks, 303–308
 - project objectives, 291–296
- Risk analysis framework, 46
 - analytic network process (ANP) modelling route, 48
 - ANP model structure development, 50–51
 - consistency test, 52–55
 - pairwise comparison, 52
 - system dynamics (SD) modelling route, 55–58
- Risk assessment, megaproject, 4–5
- Risk assessment framework, 5–6, 11, 223
- Risk assessment matrix (RAM), 224
- Risk clusters, 58
 - economic risks, 64
 - completion risks, 67–68
 - market risk, 68
 - environmental risks, 68–70
 - political risks, 70–74
 - social risks, 59–61
 - technical risks, 61–64
- Risk interdependency matrix, 93
 - potential risks cluster, 95
 - potential risks sub-clusters, 95–109
 - project objectives cluster, 93
- Risk management, 4, 5, 12, 43, 67
- Risk Priority Index (RPI), 55, 124–128, 255, 259, 260
- Risk quantification, 77
 - analysis of risk interdependency, 77
 - adjustments of participants’ opinions, 85
 - descriptive quantitative results and analysis, 82–84
 - qualitative approaches, 78–81
 - quantitative approach, 81–82

- standardized quantitative results and analysis, 84–85
- analytic network process (ANP) model, 85–92
- consistency test, 119–124
- pairwise comparison, 92–93
- risk interdependency matrix, 93
 - potential risks cluster, 95
 - potential risks sub-clusters, 95–109
 - project objectives cluster, 93
- Risk Priority Index (RPI), 124–128
- risk rating, 119
- supermatrix calculation, 110–119
- Risk rating, 119
- Risk simulation
 - project risk systems model, 131–140
 - STEEP risks system, 141–162
 - system validation, 216, 218–219
 - system verification, 162–163, 165
- Risks ratings, deriving priorities for, 120
- Royal Assent, 16
- SDANP
 - framework, 46, 47
 - methodology, 1, 7, 11–12
 - practical guide for using, 230
 - procedure, for risks reduction in megaprojects, 228–229
 - risk assessment approach, 225–226
 - tests for building confidence in integrated models, 253–254
- Sensitivity analysis, 259
 - behaviour mode, 260–280
 - numerical, 259–260
- Shandwick Place and Haymarket, disruption of, 26
- Social, technical, economic, environmental and political (STEEP) risks, 1, 4–8, 10–12, 46, 50, 84, 85, 89–90, 123, 128–129, 250, 251, 252, 254, 255, 256, 258, 259
 - ANP inputs to, 184, 195
 - boundary adequacy, 219
 - causal loop diagram (CLD), on ETN project, 132
 - dimensional consistency requirements, 219
 - dynamic hypothesis of, 135
 - dynamic simulations, 184, 196–216
 - economic risks system, 148–154
 - environmental risks system, 154–157
 - evaluation tests for, 170, 185–194
 - integrated SFMs for, 165–169
 - model equation formulation, 169–170, 184
 - one-way analysis of variance, 217
 - parameter verification of, 219
 - political risks system, 157–162
 - risk types, 139
 - SD equation representation, 184
 - social risks system, 141–145
 - STEEP factors, 44, 46, 52, 58
 - STEEP models, 254, 276
 - structural verification of, 218
 - technical risks system, 145–148
- Social risk entry points, 61
- Social risks cluster, 59–62
- Social risks model, 141, 144, 146, 255, 260
- Social risks system, 141
 - ANP inputs, 195

- causalities, for stock variables, 144–145, 146
- causal loop diagram for, 141, 142
- dynamic simulation results and discussion, 196–198, 199, 202
- evaluation tests for, 185
- integrated SFMs for, 167
- mathematical equation, for system variables, 171–172
- one-way analysis of variance, 217
- system boundary for, 136
- vicious cycle
 - of grievance prevention, 143–144
 - of social risks generation, 141–143
- Social risk sub-cluster
 - final mode ANP decision-making priorities for, 114
- Social risk variables
 - pairwise comparison matrix for, 98
 - verbal ratings for, 121
- Special purpose vehicle (SPV), 66, 67, 68
- Stock and flow STEEP models, 165–169
 - economic risk system, 168
 - environmental risks system, 169
 - political risks system, 170
 - social risks system, 167
 - technical risks system, 167
- Structural verification, of STEEP models, 170, 218, 255
- Structured interview questionnaire and participants, 289–290
- Suitability, tests of, 255
 - boundary adequacy, 255–257
 - dimensional consistency, 257
 - extreme conditions, 258
 - parameter verification, 255
 - structure verification, 255
- Super Decisions Software, 55, 95
- Supermatrix calculation, 110–119
- System Design Services (SDS), 17
- System dynamics (SD) approach, 224, 227
- System dynamics (SD) method, 1–2, 5, 47, 55–58, 259
- Technical risk cluster, 61–64
- Technical risks in megaprojects, 65–66
- Technical risks system, 145–148
 - ANP inputs, 195
 - causalities, for stock variables, 148, 149, 150
 - causal loop diagram for, 145, 147
 - dynamic simulation results and discussion, 198, 201, 203, 205
 - evaluation tests for, 185
 - integrated SFMs for, 167
 - mathematical equation, for system variables, 173–175
 - one-way analysis of variance, 217
 - system boundary for, 137
- Technical risk sub-cluster
 - final mode ANP decision-making priorities for, 115
- Technical risk variables
 - pairwise comparison matrix for, 100
 - verbal ratings for, 121
- Technical uncertainties, 133–135
- Total priority value (TPV), 93, 95
- Total risk priority index (TRPI), 110
- Traffic Regulation Orders (TROs), 257

- Train a Grande Vitesse (TGV)
 - project, in France, 156–157
- Transportation megaprojects, 3, 5, 67, 77–78, 128, 145, 148, 152, 156, 161, 162, 201, 218, 231, 234, 254–255, 282
 - dynamics simulation models for, 285–286
 - disaggregation of, 283
- Transport initiatives Edinburgh (tie), 16–17, 25, 28, 32, 33
- Unweighted super matrix for potential risks, 111
- Uses tree diagrams
 - economic risks model, 154
 - environmental risks model, 159
 - political risks model, 163
 - social risks model, 146
 - technical risks model, 150
 - technical uncertainties, 133, 134
- Validation
 - defined, 216, 218
 - model. *See* Model validation system, 216, 218–219
- Variation orders (VOs), 151
- Vensim software, 219, 257, 280, 288
- Verbal ratings
 - economic risk variables, 122
 - environmental risk variables, 123
 - political risk variables, 123
 - potential risks, 120
 - social risk variables, 121
 - technical risk variables, 121
- Verification
 - defined, 218
 - parameter, 219, 255
 - structure, 218, 255
 - system, 162–163, 165
- Weighted quantitative score (WQS)
 - method, 49, 77–78, 85, 219, 255
- Weighted supermatrix, 110
 - potential risks, 112