

Index

• Numerics •

1-10-100 rule, 179

80:20 rule, 57

• A •

AARs (After Action Reviews), 173

Ackoff, Russ, 273

affinity diagrams, 28–30

alternate hypothesis, 136

Altshuller, Genrich, 195

amber light state, 128–129

Analyse phase of DfSS, 198–200

analysing performance

cause and effect diagrams, 140–141

common problems, identifying, 139–143

comparing processes. *See* process

sigma values

correlation coefficients, 146–148

CTQs, 71–72

design of experiments, 147–148

fishbone diagrams, 140–141

interrelationship diagrams, 141–142

multiple regression, 147–148

OEE (overall equipment effectiveness),
152

OPE (overall process effectiveness),
152

overall effectiveness, 148–152

r values, 146–148

root causes, identifying, 146–148

simple linear regression, 147–148

SIPOC diagrams, 142

Takt time, 149–151

analysing performance, balance of
measures

developing measures, 143–145

logical cause testing, 145–146

relationships between variables, 143

reviewing measures, 143–145

analysis paralysis, 268–269

andon (flashing light), 190

ANOVA, 136–137

anti-solution brainstorming, 178

associations, sources of help, 278

assumption busting, 248

attitude and energy scale, 250

Attribute Agreement Analysis, 102–104

attribute charts, 126

attribute data, 104

autonomation, 12, 176

averages, limitations of, 221

• B •

backwards visioning, 246

balance of measures

developing measures, 143–145

logical cause testing, 145–146

relationships between variables, 143

reviewing measures, 143–145

batch processing, bottlenecks, 191

benchmarking, 195, 208–210

best practices

building in prevention, 259–260

challenging processes, 260

champions, 264

going to the Gemba, 261

keeping things simple, 258–259

picking the right tools, 262–263

process management with Lean Six
Sigma, 261–262

senior executive duties, 257–258

storyboarding, 263

strategic change, 264

bias, avoiding in research, 64

Black Belt, 38–39

books and periodicals

Implementing Six Sigma, 279
Integrated Enterprises, 279
International Journal of Six Sigma and Competitive Advantage, 279
iSixSigma Magazine, 279
Lean For Dummies, 152
The Lean Six Sigma Improvement Journey Toolkit, 279
The Machine That Changed The World, 279
Making Six Sigma Last, 279
Moments of Truth, 93
Practitioner's Guide to Statistics and Lean Six Sigma for Process Improvements, 278
Quality World, 279
Quantitative Approaches in Business Studies, 279
Six Sigma For Dummies, 125, 147
Six Sigma Forum, 280
The Six Sigma Revolution, 279
The Six Sigma Way, 279
Six Sigma Workbook For Dummies, 125, 147
SPC in the Office, 279
The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer, 279
UK Excellence, 280

bottlenecks. *See also* constraints; theory of constraints

batch processing, 191

cell manufacturing techniques, 191–193

definition, 185

just in time production, 190

overproduction, 189–190

in process maps, 83

product families, 193–194

in the production cycle, 189–191

pull versus push production, 189–190

single piece flow, 190

wasted movement, 191

workplace layout, 191–193

brainstorming, 178

Breyfogle, Forrest, III, 279
 buffers, theory of constraints, 188–189



capability indices, 129–133

cards. *See* kanban cards

Carlzon, Jan, 93

cause and effect diagrams, 140–141

Cavanagh, Roland, 279

cell manufacturing techniques, bottlenecks, 191–193

champions, 226–227, 264, 276

change

- assessing team progress, 253–254
- assumption busting, 248
- change management, 242–244
- change reactions, 249
- cultural webs, 247–248
- deadbeats, 250
- energy and attitude scale, 250
- forcefield diagram, 251
- key elements of change, 253–254
- key stakeholders, 252
- lack of support, 270
- organisational culture, 247–248
- overcoming resistance, 244–245
- reactions to, 249
- spectators, 250
- stakeholder analysis, 251–253
- terrorists, 250
- winners, 250

chaos state, 128, 129

charts, control. *See also* graphic representation, processes

- anomalies, 123–126
- attribute charts, 126
- creating, 122–123
- examining processes, 127–129
- individuals charts, 126–127
- overview, 121–122
- process stability, 123

- selecting, 126–127
- special causes of variation, identifying, 123–126
- variable charts, 126
- variation in processes, 127–129
- X moving R charts, 126–127
- check sheets, 105–107
- Clarke, Estelle, 244
- colleagues, sources of help, 275
- collecting data. *See also* sampling
 - Attribute Agreement Analysis, 102–104
 - attribute data, 104
 - check sheets, 105–107
 - collection techniques, 105–107
 - concentration diagrams, 106–107
 - continuous data, 104
 - cycle time, 101
 - Gauge R and R, 102–104
 - improving your approach, 107–108
 - most important data, 101
 - MSA (measurement System Analysis), 102–104
 - operational definitions, 102
 - output measures, 100–102
 - repeatability, 103–104
 - reproducibility, 103–104
 - rules for validity and consistency, 102–104
 - upstream variables, 107–108
- common cause variation, 117–119
- common mistakes. *See* pitfalls
- competitive analysis, 204–206
- complacency, 271–272
- concentration diagrams, 106–107
- conferences, sources of help, 278
- confidence intervals, 111–115
- consistency of data, 102–104
- constraints, 185–186. *See also*
 - bottlenecks; theory of constraints
- consultancy companies, sources of help, 281
- contact error proofing, 180
- continuous data, 104
- continuous improvement, 37
- control charts. *See also* graphic representation, processes
 - anomalies, 123–126
 - attribute charts, 126
 - creating, 122–123
 - examining processes, 127–129
 - individuals charts, 126–127
 - overview, 121–122
 - process stability, 123
 - selecting, 126–127
 - special causes of variation, identifying, 123–126
 - variable charts, 126
 - variation in processes, 127–129
 - X moving R charts, 126–127
- control plans, 33–34
- controlled convergence, 213–216
- correlation, 210–212
- correlation coefficients, 146–148
- Criteria Selection Matrix, 234–236
- CTQs (Critical to Quality). *See also*
 - customer requirements
 - definition, 18
 - developing, 65–69
 - examples, 67–69
 - identifying root causes, 69–70
 - outside-in thinking, 71–72
 - performance measures, 71–72
 - prioritising, 70–71
- cultural webs, 247–248
- current state process maps, 78
- customer focus, 23–24
- customer needs, QFD, 204
- customer requirements. *See also* CTQs (Critical to Quality)
 - delighters, 54
 - dissatisfiers, 54
 - Kano model, 53–55
 - must-bes, 54
 - one-dimensionals, 54
 - prioritising, 57

- customer requirements (*continued*)
 - satisfiers, 54
 - segmenting, 56–57
 - VOC (Voice of Customer), 55–57
- customer requirements, researching
 - avoiding bias, 64
 - focus groups, 61–62
 - interviewing customers, 60–61
 - observational research, 63
 - overview, 57–59
 - potential issues, 59
 - qualitative research, 59
 - quantitative research, 59
 - surveys, 62–63
- customers
 - graphic representation, 48–51
 - internal versus external, 45–47
 - perspectives on waste, 166–167
- cycle time
 - data collection, 101
 - definition, 18
 - process maps, 82
- D •
- data collection. *See also* sampling
 - Attribute Agreement Analysis, 102–104
 - attribute data, 104
 - check sheets, 105–107
 - collection techniques, 105–107
 - concentration diagrams, 106–107
 - continuous data, 104
 - cycle time, 101
 - Gauge R and R, 102–104
 - improving your approach, 107–108
 - most important data, 101
 - MSA (measurement System Analysis), 102–104
 - operational definitions, 102
 - output measures, 100–102
 - repeatability, 103–104
 - reproducibility, 103–104
 - rules for validity and consistency, 102–104
 - upstream variables, 107–108
- data presentation. *See also* control charts; graphic representation, processes
 - histograms, 133–135
 - run charts, 120–121
 - tampering, 119–120
- data presentation, variation
 - common cause, 117–119
 - natural, 117–119
 - in processes, 127–129
 - special cause, 117–119, 123–126
- data quality, importance of, 98
- De Hodgins, Ofelia C., 278
- dead time, 83
- deadbeats, 250
- defect opportunity, definition, 21
- defect prevention
 - building in, 259–260
 - Laozu’s comments on, 169
- defect prevention, housekeeping
 - AARs (After Action Reviews), 173
 - red-tag exercises, 171–172
 - scrubbing, 170
 - sorting, 170
 - standardising, 171
 - straightening, 170
 - systemising, 171
 - unnecessary items, identifying, 171–172
 - visual management, 172–175
- defect prevention, spreading the load
 - avoiding peaks and troughs, 182–184
 - Heijunka, 182–183
 - levelling, 183
 - Mura, 184
 - Muri, 184
 - process unevenness, 183–184

- sequencing, 183
- stability, 183
- standardisation, 183, 184
- defect prevention, tools and techniques
 - 1-10-100 rule, 179
 - autonomation, 176
 - contact error proofing, 180
 - error proofing processes, 179–180
 - failure modes, 176–178
 - fixed value error proofing, 180
 - FMEA (failure mode effects analysis), 176–178
 - Jidoka, 175–176
 - motion step error proofing, 180
 - negative brainstorming, 178
 - Poka-yoke, 179
 - preventive maintenance, 181
 - RPN (risk priority number), 177–178
- defective, definition, 21
- defects, definition, 21
- Define, Measure, Analyse, Design, Verify (DMADV)
 - versus DMAIC, 201–202
 - phases, 196–197
- Define, Measure, Analyse, Improve and Control (DMAIC). *See* DMAIC (Define, Measure, Analyse, Improve and Control)
- Define phase of DfSS, 197–198
- delighters, 54
- deploying Six Sigma, 219–227
- deployment flowcharts, 80–83
- deployment management, help, 281
- deployment programme manager, 223–225
- design of experiments, 147–148
- Design phase of DfSS, 200
- DfSS (Design for Six Sigma). *See also* QFD (quality function deployment)
 - Analyse phase, 198–200
 - controlled convergence, 213–216
 - decision making, 213–216
 - Define phase, 197–198
 - definition, 196
 - Design phase, 200
 - DMADV phases, 196–197
 - DMAIC versus DMADV, 201–202
 - Measure phase, 198
 - Pugh Matrix, 213–216
 - Verify phase, 200–201
- diagrams. *See* graphic representation, performance analysis; *specific diagrams*
- dissatisfiers, 54
- DMADV (Define, Measure, Analyse, Design, Verify)
 - versus DMAIC, 201–202
 - phases, 196–197
- DMAIC (Define, Measure, Analyse, Improve and Control)
 - adjusting to your needs, 37
 - affinity diagrams, 28–30
 - analysing processes, 32–33
 - control charts, 32
 - control plans, 33–34
 - defining your project, 26–31
 - definition, 25
 - versus DMADV, 201–202
 - identifying key drivers, 31
 - improvement charters, 26–28
 - interrelationship diagrams, 28–31
 - issue statements, 28–29
 - Kai Sigma events, 238–240
 - measuring the work, 32
 - phases of, 25–26, 34–37
 - projects, starting, 237
 - quantifying opportunities, 35–36
 - storyboarding, 31
 - tollgate reviews, 34–37
- doing wrong things right, 273–274
- drum concept, theory of constraints, 188–189
- Dyson, James, 199

• E •

Eckes, George, 243, 279
 effectiveness, 148–152
 80:20 rule, 57
 energy and attitude scale, 250
 environment, process element, 44
 environmental waste, 166
 equipment, process element, 43
 ergonomics, effects on waste, 164
 error proofing processes, 179
 essential NVAs, 157–159
 executive sponsorship, 220–221

• F •

facilitators, 239
 failure factors, transformation to Six Sigma, 242
 failure modes, 176–178
 fishbone diagrams, 140–141
 fixed value error proofing, 180
 flashing light (andon), 190
 flow, removing constraints, 14–15
 FMEA (failure mode effects analysis), 176–178
 focus groups, 61–62
 forcefield diagram, 251
 future state process maps, 78

• G •

Galvin, Bob, 16
 Gauge R and R, 102–104
 Gemba
 definition, 74
 going to, 24, 261
 workplace layout, bottlenecks, 191–193
 General Electric, 15–16
 getting started with Six Sigma
 assessing team progress, 253–254
 assumption busting, 248

candidate projects, 229–234
 change management, 242–244
 change reactions, 249
 common tools, 239
 Criteria Selection Matrix, 234–236
 cultural webs, 247–248
 deadbeats, 250
 DMAIC projects, 237
 energy and attitude scale, 250
 facilitators, 239
 fitting approach to project, 236–237
 forcefield diagram, 251
 initial focus, 233–236
 Kai Sigma events, 238–240
 key elements of change, 253–254
 key stakeholders, 252
 lack of support, 270
 management and leadership, 225–226
 organisational culture, 247–248
 overcoming resistance, 244–245
 prioritisation techniques, 240
 prioritising projects, 233–234
 rapid improvement, 238–240
 reactions to, 249
 selection techniques, 240
 spectators, 250
 staffing, 229–236
 stakeholder analysis, 251–253
 stifling a new programme, 270–271
 terrorists, 250
 winners, 250
 going to the Gemba, 24, 261
 Goldratt, Eliyahu, 14, 186
 graphic representation, data. *See* data presentation
 graphic representation, performance analysis
 cause and effect diagrams, 140–141
 fishbone diagrams, 140–141
 interrelationship diagrams, 141–142
 scatter diagrams, 145–146, 148
 SIPOC diagrams, 142

graphic representation, processes. *See*
 also charts; process maps; value
 stream maps
customers, 48–51
high-level process, 48–51
inputs, 48–51
outputs, 48–51
SIPOC (Suppliers, Inputs, Process,
 Outputs, Customers) diagrams,
 48–51
suppliers, 48–51
Green Belt, 38–39
green light state, 128
Gustafson, Terry, 147
Gygi, Craig, 147

• H •

Harry, Mike J., 278
Heijunka
 defect prevention, spreading the load,
 182–184
 definition, 11–12
help, sources of
 associations, 278
 books, 278–279
 champions, 276
 colleagues, 275
 conferences, 278
 consultancy companies, 281
 deployment management, 281
 Implementing Six Sigma, 279
 Integrated Enterprises, 279
 *International Journal of Six Sigma and
 Competitive Advantage*, 279
 the Internet, 276–277
 iSixSigma Magazine, 279
 Lean For Dummies, 152
 *The Lean Six Sigma Improvement
 Journey Toolkit*, 279
 The Machine That Changed The World,
 279
 Making Six Sigma Last, 279
 Moments of Truth, 93

networks, 278
other organisations, 276
periodicals, 279–280
*Practitioner's Guide to Statistics
 and Lean Six Sigma for Process
 Improvements*, 278
Quality World, 279
*Quantitative Approaches in Business
 Studies*, 279
search engines, 277
Six Sigma For Dummies, 125, 147
Six Sigma Forum, 280
The Six Sigma Revolution, 279
The Six Sigma Way, 279
Six Sigma Workbook For Dummies,
 125, 147
software, 280–281
SPC in the Office, 279
statistical analysis, 280–281
*The Toyota Way: 14 Management
 Principles from the World's Greatest
 Manufacturer*, 279
training companies, 281
UK Excellence, 280
house diagram, TPS, 11
House of Quality. *See also* DfSS (Design
 for Six Sigma); QFD (quality function
 deployment)
 benchmarking, 208–210
 characteristics, 206
 competitive analysis, 204–206
 correlation, 210–212
 customer needs, 204
 limits, 210
 measures, 206
 overview, 203
 prioritising needs, 204–206
 QFD drill-down, 212–213
 relationships, 206–208
 targets, 210
housekeeping
 AARs (After Action Reviews), 173
 red-tag exercises, 171–172
 scrubbing, 170

housekeeping (*continued*)

- sorting, 170
- standardising, 171
- straightening, 170
- systemising, 171
- unnecessary items, identifying, 171–172
- visual management, 172–175

Hulbert, Richard L., 278

human potential, wasting, 165–166

hypothesis testing, 136

● 1 ●

icons in this book, 5

ideal state, 128

ignoring the soft stuff, 271

Implementing Six Sigma, 279

improvement charters, 26–28

individuals charts, 126–127

inputs, graphic representation, 48–51

Integrated Enterprises, 279

International Journal of Six Sigma and Competitive Advantage, 279

the Internet, sources of help, 276–277

interrelationship diagrams, 28–31,
141–142

interviewing customers, 60–61

inventory, waste, 163

iSixSigma Magazine, 279

issue statements, 28–29

● 1 ●

Jidoka

defect prevention, 175–176

definition, 12–13

JIT (just in time)

definition, 13

production bottlenecks, 190

pull production, 13

single piece flow, 13

Takt time, 14

Jobs, Steve, 196

Johnson, Gerry, 247

jumping to solutions, 221,
267–268

● K ●

Kai Sigma events, 238–240

Kaizen, 37

Kaizen blitz events, 37

kanban cards, definition, 190

Kano model, 53–55

Key Concept icon, 5

key drivers, identifying, 31

key stakeholders, 252

Kotter, John P., 242

Kracik, John, 10

● L ●

lack of support, 270

Lacke, Christopher J., 278

Laozu, on defect prevention, 169

lead time. *See* cycle time

leadership. *See* management and
leadership

Lean

history of, 9–10

key principles, 15

Lean For Dummies, 152

Lean Six Sigma, process management,
261–262

*The Lean Six Sigma Improvement Journey
Toolkit*, 279

levelling

defect prevention, spreading the

load, 182–184

definition, 11–12

Liker, Jeffrey, 279

logical cause testing, 145–146

• M •

The Machine That Changed The World, 279

machines, autonomous operation. *See* automation

Making Six Sigma Last, 279

management and leadership

 deploying Six Sigma, 219–227

 deployment programme manager, 223–225

 executive sponsorship, 220–221

 facilitators, 239

 organisational size, 222–223

 project champions, 226–227

 required roles, 219

 senior executive duties, 257–258

 Six Sigma start up, 225–226

 techniques to encourage, 221

managing by fact, 25

Mann, Prem S., 278

mapping. *See* graphic representation, processes

maps, process. *See also* graphic representation, processes

 bottlenecks, 83

 conventions, 79–80

 current state, 78

 cycle time, 82

 dead time, 83

 definition, 47–51

 deployment flowcharts, 80–83

 description, 47–51

 elapsed time. *See* cycle time

 future state, 78

 lead time. *See* cycle time

 measuring time, 82–83

 moments of truth, 80

 process stapling, 74–76

 questions to ask, 78–79

 spaghetti diagrams, 76–77

 swim lane charts, 81

 symbols, 79–80

 touch points, 80

 tracking workflow, 74–77

 unit time, 82

maps, value stream. *See also* graphic representation, processes; process maps

 description, 84–85

 drawing, 85–87

 example, 87–93

Mars Lander failure, 102

materials, process element, 44

MBB (Master Black Belt), 38–39

Measure phase of DfSS, 198

Measurement System Analysis (MSA), 102–104

measures

 identifying relevant, 99–100

 output, 100–102

 reviewing current, 98–99

measuring

 time with process maps, 82–83

 work with DMAIC, 32

methodology madness, 269

methods, process element, 43

mistakes, common. *See* pitfalls

moments of truth

 definition, 80

 identifying, 93–94

 in process maps, 80

Moments of Truth, 93

Morgan, John, 279

Morris, Clare, 279

motion step error proofing, 180

Motorola, 16

MSA (Measurement System Analysis), 102–104

Muda, 160. *See also* waste categories

multiple regression, 147–148
 Mura, 184
 Muri, 184
 must-bes, 54
 myths of Six Sigma, 272–273

• N •

NASA Mars Lander failure, 102
 natural variation, 117–119
 negative brainstorming, 178–179
 networks, sources of help, 278
 Neuman, Robert, 279
 non-value-added steps, 157–159
 null hypothesis, 136

• O •

observational research, 63
 OEE (overall equipment effectiveness), 152
 Ohno, Taiichi
 history of Lean, 9–10
 removing waste, 160
 TPS approach, 10
 value stream maps, 84
 on the brink state, 128, 129
 1-10-100 rule, 179
 one-dimensionals, 54
 OPE (overall process effectiveness), 152
 operational definitions, 102
 organisational culture, 247–248
 output measures, 100–102
 outputs, graphic representation, 48–51
 outside-in thinking, 71–72
 over-processing, waste, 162–163
 overproduction
 bottlenecks, 189–190
 waste, 161
 overtraining, 274

• P •

p values, 137
 Pande, Peter, 279
 Pareto, Vilfredo, 57
 peaks and troughs, avoiding, 182–183
 PEMME (People, Equipment, Method, Materials, Environment), 43–44. *See also* processes
 people
 assumption busting, 248
 cultural webs, 247–248
 human potential, wasting, 165–166
 involving and equipping, 25
 organisational culture, 247–248
 process element, 43
 staffing Six Sigma, 229–236
 people coping with change
 assessing team progress, 253–254
 assumption busting, 248
 change management, 242–244
 change reactions, 249
 cultural webs, 247–248
 deadbeats, 250
 energy and attitude scale, 250
 forcefield diagram, 251
 key elements of change, 253–254
 key stakeholders, 252
 organisational culture, 247–248
 overcoming resistance, 244–245
 spectators, 250
 stakeholder analysis, 251–253
 terrorists, 250
 transformation failure factors, 242
 winners, 250
 people issues
 backwards visioning, 246
 change management, 242–244
 creating a vision, 245–247

- overcoming resistance, 244–245
- transformation failure factors, 242
- people power, TPS, 11
- performance analysis
 - cause and effect diagrams, 140–141
 - common problems, identifying, 139–143
 - comparing processes. *See* process sigma values
 - correlation coefficients, 146–148
 - CTQs, 71–72
 - design of experiments, 147–148
 - fishbone diagrams, 140–141
 - interrelationship diagrams, 141–142
 - multiple regression, 147–148
 - OEE (overall equipment effectiveness), 152
 - OPE (overall process effectiveness), 152
 - overall effectiveness, 148–152
 - r values, 146–148
 - root causes, identifying, 146–148
 - simple linear regression, 147–148
 - SIPOC diagrams, 142
 - Takt time, 149–151
- performance analysis, balance of measures
 - developing measures, 143–145
 - logical cause testing, 145–146
 - relationships between variables, 143
 - reviewing measures, 143–145
- pictures. *See* graphic representation, processes
- Piggly Wiggly supermarket, 9–10
- pitfalls
 - analysis paralysis, 268–269
 - believing in myths, 272–273
 - complacency, 271–272
 - doing wrong things right, 273–274
 - ignoring the soft stuff, 271
 - jumping to solutions, 221, 267–268
 - lack of support, 270
 - methodology madness, 269
 - overtraining, 274
 - scope scandals, 269
 - stifling a new programme, 270–271
 - team turmoil, 270
 - ‘We’re already doing it.’, 272
- Poka-yoke, 179
- population sampling, 111–115
- Practitioner’s Guide to Statistics and Lean Six Sigma for Process Improvements*, 278
- precision, sampling, 111–115
- presenting data. *See also* control charts; graphic representation, processes
 - histograms, 133–135
 - run charts, 120–121
 - tampering, 119–120
- presenting data, variation
 - common cause, 117–119
 - natural, 117–119
 - in processes, 127–129
 - special cause, 117–119, 123–126
- preventing defects
 - building in, 259–260
 - Laozu’s comments on, 169
- preventing defects, housekeeping
 - AARs (After Action Reviews), 173
 - red-tag exercises, 171–172
 - scrubbing, 170
 - sorting, 170
 - standardising, 171
 - straightening, 170
 - systemising, 171
 - unnecessary items, identifying, 171–172
 - visual management, 172–175
- preventing defects, spreading the load
 - avoiding peaks and troughs, 182–184
 - Heijunka, 182–183
 - levelling, 183
 - Mura, 184
 - Muri, 184
 - process unevenness, 183–184
 - sequencing, 183
 - stability, 183
 - standardisation, 183–184

- preventing defects, tools and techniques
 - 1-10-100 rule, 179
 - autonomation, 176
 - contact error proofing, 180
 - error proofing processes, 179
 - failure modes, 176–178
 - fixed value error proofing, 180
 - FMEA (failure mode effects analysis), 176–178
 - Jidoka, 175–176
 - motion step error proofing, 180
 - negative brainstorming, 178
 - Poka-yoke, 179
 - preventive maintenance, 181
 - RPN (risk priority number), 177–178
- preventive maintenance, 181
- principles of Six Sigma. *See also specific principles*
 - customer focus, 23–24
 - going to the Gemba, 24
 - involving and equipping people, 25
 - managing by fact, 25
 - overview, 22
 - process flow control, 24
 - reducing variation, 25
 - removing waste, 24
 - systematic improvement, 25
 - value stream, 24
- prioritisation techniques, 240
- prioritising
 - CTQs, 70–71
 - customer requirements, 57
 - needs with QFD, 204–206
 - with paired comparisons, 70–71
 - projects, 233–234
- process flow control, 24
- process improvement. *See* DMAIC (Define, Measure, Analyse, Improve and Control)
 - process maps. *See also* graphic representation, processes
 - bottlenecks, 83
 - conventions, 79–80
 - current state, 78
 - cycle time, 82
 - dead time, 83
 - definition, 47–51
 - deployment flowcharts, 80–83
 - description, 47–51
 - elapsed time. *See* cycle time
 - future state, 78
 - lead time. *See* cycle time
 - measuring time, 82–83
 - moments of truth, 80
 - process stapling, 74–76
 - questions to ask, 78–79
 - spaghetti diagrams, 76–77
 - swim lane charts, 81
 - symbols, 79–80
 - touch points, 80
 - tracking workflow, 74–77
 - unit time, 82
 - process owners, 55
 - process performance
 - capability indices, 129–133
 - process sigma values, calculating, 18–22
 - process rhythm. *See* Takt time
 - process sigma values, calculating, 18–22
- processes
 - amber light state, 128–129
 - on the brink state, 128, 129
 - capability indices, 129–133
 - challenging, 260
 - chaos state, 128, 129
 - customers, internal versus external, 45–47
 - definition, 43
 - elements of, 43–45

environment, 44
 equipment, 43
 error proofing, 179–180
 examining, 127–129
 green light state, 128
 ideal state, 128
 managing with Lean Six Sigma, 261–262
 materials, 44
 method, 43
 people, 43
 red light state, 128, 129
 sampling, 109–110
 stability, 118, 123
 stapling, 74–76
 state, examining, 127–129
 statistical control, 118
 sub-optimisation, waste, 161
 symptoms of poor health, 231–232
 threshold state, 128–129
 unevenness, 183–184
 variation, 127–129
 processes, graphic representation
 customers, 48–51
 high-level process, 48–51
 inputs, 48–51
 outputs, 48–51
 process maps, 47–51
 SIPOC (Suppliers, Inputs, Process, Outputs, Customers) diagrams, 48–51
 suppliers, 48–51
 product families, bottlenecks, 193–194
 project champions, 226–227, 264, 276
 projects, selecting for Six Sigma, 229–237
 Pugh, Stuart, 214
 Pugh Matrix, 213–216
 pull production, 13
 pull versus push production,
 bottlenecks, 189–190

• Q •

QFD (quality function deployment). *See*
 also DfSS (Design for Six Sigma)
 benchmarking, 208–210
 characteristics, 206
 competitive analysis, 204–206
 correlation, 210–212
 customer needs, 204
 drill-down, 212–213
 House of Quality, 203–212
 limits, 210
 measures, 206
 overview, 203
 prioritising needs, 204–206
 QFD drill-down, 212–213
 relationships, 206–208
 targets, 210
 qualitative research, 59
 quality. *See* House of Quality; QFD
 (quality function deployment)
 Quality World, 279
 quantifying opportunities, 35–36
Quantitative Approaches in Business
 Studies, 279
 quantitative research, 59

• R •

r values, 146–148
 rapid improvement events, 37
 red light state, 128, 129
 red-tag exercises, 171–172
 reducing variation, 25
 regression, 147–148
 relationships
 House of Quality, 206–208
 interrelationship diagrams, 28–31,
 141–142
 QFD (quality function deployment),
 206–208
 between variables, 143

- Remember icon, 5
 - repeatability, 103–104
 - reproducibility, 103–104
 - required roles, 219
 - requirements. *See also* CTQs (Critical to Quality)
 - delighters, 54
 - dissatisfiers, 54
 - Kano model, 53–55
 - must-bes, 54
 - one-dimensionals, 54
 - prioritising, 57
 - satisfiers, 54
 - segmenting, 56–57
 - VOC (Voice of Customer), 55–57
 - requirements, researching
 - avoiding bias, 64
 - focus groups, 61–62
 - interviewing customers, 60–61
 - observational research, 63
 - overview, 57–59
 - potential issues, 59
 - qualitative research, 59
 - quantitative research, 59
 - surveys, 62–63
 - researching customer requirements
 - avoiding bias, 64
 - focus groups, 61–62
 - interviewing customers, 60–61
 - observational research, 63
 - overview, 57–59
 - potential issues, 59
 - qualitative research, 59
 - quantitative research, 59
 - surveys, 62–63
 - researching process improvement
 - identifying relevant measures, 99–100
 - importance of good data, 98
 - reviewing current measures, 98–99
 - researching process improvement, data collection. *See also* sampling
 - Attribute Agreement Analysis, 102–104
 - attribute data, 104
 - check sheets, 105–107
 - collection techniques, 105–107
 - concentration diagrams, 106–107
 - continuous data, 104
 - cycle time, 101
 - Gauge R and R, 102–104
 - improving your approach, 107–108
 - most important data, 101
 - MSA (Measurement System Analysis), 102–104
 - operational definitions, 102
 - output measures, 100–102
 - repeatability, 103–104
 - reproducibility, 103–104
 - rules for validity and consistency, 102–104
 - upstream variables, 107–108
 - reviews, 34–37
 - rework, waste, 165
 - rhythm of a process. *See* Takt time
 - rope concept, theory of constraints, 188–189
 - RPN (risk priority number), 177–178
- S ●
- sampling. *See also* researching process improvement, data collection
 - confidence intervals, 111–115
 - example, 112–115
 - overview, 108–109
 - population, 111–115
 - precision, 111–115
 - process, 109–110
 - satisfiers, 54
 - Saunders, Clarence, 9–10
 - Sayer, Natalie J., 152
 - scatter diagrams, 145–146, 148
 - scope scandals, 269
 - scrubbing, 170
 - search engines, sources of help, 277
 - segmenting customers, 56–57
 - Senge, Peter, 173

- sequencing, 12, 183
- Shewhart, Walter, 121
- Shingo, Shigeo, 86
- simple linear regression, 147–148
- single minute exchange of die (SMED), 86
- single piece flow, 13, 190
- SIPOC (Suppliers, Inputs, Process, Outputs, Customers) diagrams, 48–51, 142. *See also* graphic representation, processes
- Six Sigma
- adjusting to your needs, 37
 - analogy to martial arts, 38–39
 - example, 16–17
 - name origin, 16
 - in the workplace, 17–19
- Six Sigma, key principles. *See also specific principles*
- customer focus, 23–24
 - going to the Gemba, 24
 - involving and equipping people, 25
 - managing by fact, 25
 - overview, 22
 - process flow control, 24
 - reducing variation, 25
 - removing waste, 24
 - systematic improvement, 25
 - value stream, 24
- Six Sigma For Dummies*, 125, 147
- Six Sigma Forum*, 280
- The Six Sigma Revolution*, 279
- Six Sigma start up, 225–226
- The Six Sigma Way*, 279
- Six Sigma Workbook For Dummies*, 125, 147
- size of Six Sigma organisations, 222–223
- SMED (single minute exchange of die), 86
- Smith, Bill, 16
- software
- deployment management, 281
 - statistical analysis, 280–281
- sorting, 170
- spaghetti diagrams, 76–77
- SPC (statistical process control) charts.
- See* control charts
- SPC in the Office*, 279
- special cause variation, 117–119, 123–126
- spectators, 250
- sponsorship, executive management, 220–221
- spreading the load
- avoiding peaks and troughs, 182–184
 - Heijunka, 182–183
 - levelling, 183
 - Mura, 184
 - Muri, 184
 - process unevenness, 183–184
 - sequencing, 183
 - stability, 183
 - standardisation, 183–184
- stability
- defect prevention, spreading the load, 182–184
 - processes, 118
- staffing Six Sigma, 229–236. *See also* people
- stakeholders
- analysing, 251–253
 - key, 252
- standard deviation, calculating, 16–17
- standardisation
- defect prevention, spreading the load, 182–184
 - definition, 12
 - housekeeping, 171
- starting Six Sigma
- assessing team progress, 253–254
 - assumption busting, 248
 - candidate projects, 229–234
 - change management, 242–244
 - change reactions, 249
 - common tools, 239
 - Criteria Selection Matrix, 234–236
 - cultural webs, 247–248
 - deadbeats, 250

- starting Six Sigma (*continued*)
 - DMAIC projects, 237
 - energy and attitude scale, 250
 - facilitators, 239
 - fitting approach to project, 236–237
 - forcefield diagram, 251
 - initial focus, 232–236
 - Kai Sigma events, 238–240
 - key elements of change, 253–254
 - key stakeholders, 252
 - lack of support, 270
 - management and leadership, 225–226
 - organisational culture, 247–248
 - overcoming resistance, 244–245
 - prioritisation techniques, 240
 - prioritising projects, 233–234
 - rapid improvement, 238–240
 - reactions to, 249
 - selection techniques, 240
 - spectators, 250
 - staffing, 229–236
 - stakeholder analysis, 251–253
 - stifling a new programme, 270–271
 - terrorists, 250
 - winners, 250
 - statistical analysis, sampling. *See also*
 - researching process improvement, data collection
 - confidence intervals, 111–115
 - example, 112–115
 - overview, 108–109
 - population, 111–115
 - precision, 111–115
 - process, 109–110
 - statistical analysis, software for, 280–281
 - statistical control, 118
 - statistical process control (SPC) charts. *See* control charts
 - stifling a new programme, 270–271
 - stopping the line, 13
 - storyboarding, 31, 263
 - straightening, 170
 - suppliers, graphic representation, 48–51
 - Suppliers, Inputs, Process, Outputs, Customers (SIPOC) diagrams, 48–51. *See also* graphic representation, processes
 - surveys, 62–63
 - swim lane charts, 81
 - symbols, process maps, 79–80
 - symptoms of poor process health, 231–232
 - systematic improvement, 25
 - systemising, 171
- T ●
- Takt time, 14, 149–151
 - targets, QFD, 210
 - team turmoil, 270
 - terrorists, 250
 - theories, testing, 137
 - theory of constraints. *See also*
 - bottlenecks; constraints
 - building a buffer, 188–189
 - drum concept, 188–189
 - identifying the weakest link, 185–186
 - improving process flow, 186–188
 - overview, 14–15, 186
 - rope concept, 188–189
 - threshold state, 128–129
 - “Tim Wood” waste categories, 160–161
 - time, measuring with process maps, 82–83
 - time and motion, waste, 163–164
 - Tip icon, 5
 - tollgate reviews, 34–37
 - tools and techniques
 - deployment management, 281
 - selecting, 262–263
 - software, 280–281
 - for starting Six Sigma, 239
 - statistical analysis, 280–281

tools and techniques, defect prevention
 1-10-100 rule, 179
 automation, 176
 contact error proofing, 180
 error proofing processes, 179–180
 failure modes, 176–178
 fixed value error proofing, 180
 FMEA (failure mode effects analysis),
 176–178
 Jidoka, 175–176
 motion step error proofing, 180
 negative brainstorming, 178
 Poka-yoke, 179
 preventive maintenance, 181
 RPN (risk priority number), 177–178
 touch points, process maps, 80
 Toyota, Kiichiro
 automation, 12, 176
 history of Lean, 9–10
 Toyota, customer ride-alongs, 63
*The Toyota Way: 14 Management
 Principles from the World's Greatest
 Manufacturer*, 279
 TPS (Toyota Production System)
 house diagram, 11
 jargon, 11–14. *See also specific terms*
 people power, 11
 performance attributes, 13
 training companies, 281
 training for Six Sigma
 analogy to martial arts, 38–39
 overtraining, 274
 transformation failure factors, 242
 transportation, waste, 162
 True Stories icon, 5
 T-tests, 136–137

• U •

UK Excellence, 280
 unit, definition, 21
 unit time, 82

unnecessary items, identifying, 171–172
 upstream variables, 107–108

• V •

validity of data, 102–104
 value stream maps. *See also* graphic
 representation, processes; process
 maps
 description, 84–85
 drawing, 85–87
 example, 87–93
 value streams, 24
 value-added steps
 analysing, 157–159
 criteria for, 156–157
 definition, 156–157
 essential NVAs, 157–159
 non-value-added steps, 157–159
 opportunities for, 160
 variable charts, 126
 variation
 common cause, 117–119
 natural, 117–119
 in processes, 127–129
 special cause, 117–119, 123–126
 Verify phase of DfSS, 200–201
 visual management, 172–175, 221
 vital few, focusing on the, 167–168
 VOC (Voice of Customer), 55–57

• W •

waiting, waste, 162
 Warning icon, 5
 waste categories. *See also* Muda; *specific
 categories*
 customer perspectives on, 166–167
 environmental, 166
 ergonomics, 164
 focusing on the vital few, 167–168
 human potential, 165–166

waste categories (*continued*)

inventory, 163

over-processing, 162–163

overproduction, 161

process sub-optimisation, 161

rework, 165

summary of, 160–161

“Tim Wood,” 160–161

time and motion, 163–164

transportation, 162

unnecessary waiting, 162

waste removal, principle of Six Sigma, 24

wasted movement, bottlenecks, 191

weakest link. *See* bottlenecks;

constraints

Welch, Jack, 15–16, 220

‘We’re already doing it.’, 272

Williams, Bruce, 147, 152

winners, 250

workflow, tracking. *See* process maps;

value stream maps

workplace. *See* Gemba

workplace layout, bottlenecks, 191–193



X moving R charts, 126–127



Yellow Belt, 38–39