

# Index

---

- absolute non-substitutability 197–9  
absolute scarcity 197  
absorption capacity 36, 206, 278–80  
absorption and complexity 53, 77–8  
abundance 148, 155  
*Academy of Management Journal* see  
*AMJ*  
access arrangements, localness 115–37  
accessibility of resources 2, 144–5,  
150–151  
actorhood, organizational 165–85  
adaptability capabilities 97–105  
adaptation 53, 88–111  
adaptive systems 76, 119  
agency management 221  
agent-based process 145–6  
agglomeration theory 145, 152  
Aghion, P. 21–2  
Ahmed, P.K. 51  
Alaska Whitefish Trawlers Association  
(AWTA) 222  
Aldrich, H. 142  
allocation competition 48  
allocation rules, resource nexus 46  
Allouche, J. 45  
alternative carbon feedstock 63–4, 68,  
71  
ambidexterity 80–82, 202, 203–4  
*AMJ* terminology 2–10  
analytic strategy, case study 121–2  
Anderson, P. 45  
Andrews-Speed, P. 39–41  
Anthropocene impacts 169–70, 181–2  
anti-fragility development 50–51  
Arctic area 120–121, 123–8, 130, 201  
Arditi, D. 142  
Argyres, N. 141  
arrangement portfolios 122, 125–8  
arrangements 115–37  
asset investment 150–151  
asset portfolios 100  
asset specificity 141  
asymmetric dependence 118, 130  
atmosphere 277–82, 289  
attitudes 20, 117, 128, 130  
auctions 273, 275–8, 280, 288–90  
Auster, E.R. 142  
auto-consumption 187, 189–90, 196–9,  
200–202  
autonomy 117, 128, 130, 131  
AWTA see Alaska Whitefish Trawlers  
Association  
  
Baird, Spencer 173–4  
Baker, T. 4  
Bastian, B. 202  
behavioural plasticity 51  
belief in sensemaking 233  
Bergson, Henri 212  
Berkes, F. 131  
Berle, A.A. 253  
binding arrangements 279–80  
binding thresholds, immissions 274–5  
biomass 67–8  
biophysical constraints 37  
Bleischwitz, R. 53  
blockchain technology 15, 283–4, 289  
Bode, C. 4  
Boisot, M. 50  
Boone, C. 4  
boundary decisions 140–141, 142, 155  
bridging actors 127  
broad scope arrangements 125  
brown coal 71  
Brundtland sustainability concept  
248  
‘bundles of property rights’ 190–194  
business models 1, 14, 54, 103–4  
business needs, resource nexus 40–41  
Butler, J.E. 187, 205  
buying-back process 280  
bycatch 221–2, 224, 229–32

- Canada's Oil Sands Innovation Alliance (COSIA) 103
- 'cap, auction and dividend' 277
- 'cap', climate change 273–4, 276
- capabilities 97–105
  - ambidextrous strategy 203–4
  - auto-consumption 196
  - definition 188
  - and imprinting 151
- CAPEX *see* capital investment costs
- capital intensity 145, 149–50, 196
- capital investment costs (CAPEX) 66, 68
- carbon dioxide (CO<sub>2</sub>) 67–8, 83, 91, 274, 278
- carbon feedstock 63–4
- carbon sequestration 238
- Carbon Tracker 38
- Carlsson, L. 131
- Carney, M.G. 52
- Casciaro, T. 117–18
- case methods 253–6
- certificates, emissions 278, 290
- characterizations of nature 168–9, 176
- chemical industry 7, 62, 63–82
- Child, J. 50
- China 11, 16, 22
- Christianson, M. 215
- Clark, W.C. 250–251
- climate change 67–8, 95, 168, 238, 271–92
- climate protection 289
- closed system entropy 217
- CO<sub>2</sub> *see* carbon dioxide
- coal 63–4, 68, 70–75, 197
- Coase, R.H. 141
- Coca-Cola 19, 169, 256–64, 265
- codes of conduct 246–56, 264
- cognition 146
- cognitive legitimacy 250
- cognitive pillar, sustainability 249
- collaboration 78, 103–4, 107–8, 152, 170, 178–9
- collective action 52–3
- 'colored coins' 283–4
- commensalism 53
- commodity price hedging 101
- commodity resource markets 88–111
- commons
  - rights to 290
  - 'tragedy of' 272–3
- comparative case methods 253–6
- comparative evaluations 64–8
- comparative historical method 255, 259–60, 264–5
- competence-based resources 196
- competition 11, 48, 53, 189–90
- competitive advantage 186–90, 197–8, 205
- competitiveness 61–87
- complex networks 75
- complex systems 76
- complexity 45–7, 50–51, 53, 76–8, 80
- configuration
  - competitive advantage 205
  - supply chain 140, 146–7
- conflicting objectives 75, 80–82
- 'conjunctural capacity' 237–8
- 'conjunctural sensemaking' 236
- conjecturing as coping 232–4
- consumer prices 198, 277–8
- consumption 165–6, 171–2, 178
- contextual ambidexterity 81
- contingent irreversibility 225–8
- contracts 125–6, 195
- Cooper, W.H. 213–14
- coordination rules, resource nexus 46
- coping, conjecturing as 232–4
- corporate culture 79–80
- corporate governance 245–70
- corporate responses, resource nexus 50
- corporate strategies 54
- corporate sustainability 176, 246, 253, 266
- COSIA *see* Canada's Oil Sands Innovation Alliance
- costs 61, 68, 103, 277
- cradle-to-gate approach 66
- 'critical case' strategy 120
- cues, sensemaking 215
- cultural aspects, scarcity 20
- cultural constructions 180–181
- cultural differences 126
- cultural heritage 178
- cultural structures 36
- currency exchange risk 101

- Daly, H.E. 197  
 dams 175, 177–81  
 Darwin, Charles 217  
 data analysis 221, 223–5  
 data collection 121–2  
 decentralized decision making 51  
 decision making 62–3, 68–70, 75,  
     79–80, 147  
     *see also* strategic decision making  
 decision response uncertainty 49  
 Deepwater Horizon disaster 42, 103  
 demand growth 47, 89–90  
 demographic shifts effects 48  
 dense networks 125, 128, 130  
 dependence 117–19, 130  
 dependence asymmetry 118, 130  
 design innovations 14, 51–2  
 determinacy 230, 238  
 developing world 89–90, 280, 285  
 Dewey, John 216  
 dialogue-based portfolios 105  
 Dickson, N.M. 250–251  
 direct costs 61  
 dissipation 197, 212–13, 237  
 dissipative structures 217–18, 236–8  
 diversification 202  
 dividends 277  
 downstream approach, climate change  
     280, 288  
 downstream integration 148  
 Drees, J.M. 117  
 Dreyer, B. 52  
 drinking water 1–2  
     *see also* fresh water  
 dynamic capabilities 97–9, 107–8  
 dynamism 44–5, 50, 78, 80  
  
 ecological elements, sustainability  
     271–92  
 ecological sensemaking 211–41  
 economic actors 195  
 economic cost perspective 140–141  
 economic decisions 177–8  
 economic evaluation, olefins 66  
 economic growth 90–91, 186  
 economic policies 272  
 economies of scale 140  
 economy-scarcity interconnectedness  
     40  
 ecosystem effects 10, 22, 38  
  
 education 20  
 effective sensemaking 213  
 efficiency 148, 273, 275–6  
 Eisenhardt, K.M. 255  
 embedded natural resources 118–19,  
     213  
 emission certificates 278, 290  
 emission rights 273, 275–6, 278, 282,  
     288–90  
 emissions  
     carbon 238  
     oil/gas industry 91  
     olefin production 67–8  
     redistribution policy 284  
     reduction approaches 271–2  
 emissions trading 274, 276, 280, 288  
 empirical setting, case study 120–121  
 energy industry 89  
 energy investment 218  
 energy resources 2, 74–5  
     entropic processes 197  
     fishing industry 236–7  
     irreversible processes 227–8  
     oil/gas industry 99–100  
     techno-economic constraints 42  
 energy security 11  
 energy strategies 204  
 energy transition 62, 64, 70  
 enhanced oil recovery (EOR) 203  
 entrepreneurs 14–15, 21, 50, 92, 148,  
     271–92  
     *see also* small firms  
 entropy 197, 198, 217, 226, 228  
 environment, resource nexus as 44–9  
 environmental actors 167–9  
 environmental associations 177–8  
 environmental change 80–82  
 environmental constraints 15  
 environmental determinants 141,  
     145–6  
 environmental dynamism 45  
 environmental evaluation, olefins 66  
 environmental impact reports 182  
 environmental impacts 94, 168  
 environmental imprinting 154  
 environmental munificence 35  
 environmental policies 91  
 environmental risk 95–6  
 environmentally friendly products  
     277–8

- EOR *see* enhanced oil recovery  
 equilibrium, sustainability 289  
 equity rules, resource nexus 46  
 equivalence principle 273, 277–82  
 evolution, reality 217  
 expectation management 215–16  
 expected indeterminacy 216–17, 229  
 experimentation 22–3, 49  
 exploitation process 119, 169  
 exploratory test, sustainability 260–262  
 extraction contexts 214, 219, 230, 232, 235, 263, 265  
 extractive industries/sector 1, 218, 275  
   buying-back process 280  
   economic actors 195  
   finite resources 187–9, 205  
   natural imprinting 138–61  
   RBV criteria 196  
   scenarios 199–204  
   socio-political factors 90  
   vertical integration 138–61
- faith in sensemaking 233–6  
 falsification 254–5  
 feedstock 63–4, 66, 68, 70–74  
 Feinstein, Dianne 177  
 financial risk 93–4, 100–101  
 financial value, atmosphere 277–82  
 finite natural resources 186–9, 195, 197, 201, 204–6  
   *see also* fossil resources; non-renewable resources  
 firms' strategies 138, 139  
 fish populations 169, 173–5, 226  
 fishing industry 124, 167, 211–41  
 fixed irreversibility 225–6  
 Fleming, David 276  
 flexibility 51–2, 79  
 food challenges 48–9  
 food-energy nexus 39  
 food scarcity 2  
 food security 11  
 food supply 1, 284  
 Foran, T. 41  
 Foss, K. and N.J. 190  
 fossil resources 186, 290  
   depletion 67  
   emission amounts 274–5, 282  
   oil/gas industry 90–91  
   olefin production 67  
   prices 278  
 founding period, firms 139, 142–4  
 fracking process 168, 203  
 fragile systems 51  
   *see also* anti-fragility  
 frames  
   new thinking 41–9  
   scarcity 36–41  
 fresh water 18–19  
   *see also* drinking water  
 fuel challenges 48–9  
 fuel costs 66, 68, 225–6  
 functional redundancy 51  
 future research 154–6, 204–6, 237–8
- gas commodity markets 88–111  
 gas industry 89–91, 189, 194, 196, 200–203  
 George, G. 116  
 Georgescu-Roegen, N. 197  
 Germany 17, 61–82, 204  
 Geyskens, I. 138, 148  
 GHG emissions *see* greenhouse gas emissions  
 Gioia, D.D. 121–2, 125  
*The Giving Tree* (Silverstein) 165–85  
 global climate strategy 271–92  
 global drivers, resource nexus 40  
 Global Reporting Initiative (GRI) 246–9, 264–5  
 globalization 40, 89–97, 170, 251, 289  
 globally binding immission thresholds 274–5  
 globalness versus localness 47  
 goal complexity 77  
 'good Anthropocene' 170, 181–2  
 governance 21–2, 236, 245–70  
 government actions 15–17, 44, 97  
 'grand challenge' 3, 22–3, 35  
 Grant, R.M. 89  
 Grant, Ulysses S. 173–4  
 greenhouse gas (GHG) emissions 67–8, 91, 284  
 Greenland 123, 126–7, 130, 201  
 GRI *see* Global Reporting Initiative  
 Grønhaug, K. 52  
 growth-share matrices 104  
 Gruber, D.A. 216

- habits 252, 262  
 Hanmer-Lloyd, S. 52  
 Hardin, G. 272  
 hedging 101  
 heterogeneous actors 45, 48  
 heterogeneous resources 189  
 Heugens, P.P. 117  
 Hiatt, S.R. 7  
 Hillmann, Mayer 276  
 Hills, J. 256  
 historical factors 139, 141–2, 153,  
 165–85  
 historical method 255, 259–60, 264–5  
 Hoff, H. 40  
 Hoffman, A.J. 170  
 Hotelling, Howard 10  
 Hsu, D.H. 190  
 Huberman, A.M. 121  
 human assets/capital 150–151  
 human-institutional incentives 251  
 human resources 3, 4–5, 7  
     *see also* people as resources  
 human systems 55  
 hydraulic fracking 168, 203
- Iceland 124, 125–7  
 idealism 22–3  
 immissions 271–2, 274–6, 282, 288–90  
 immobility of resources 190  
 imperfect market competition 11  
 import dependency 70–71  
 imprinters *see* prominent  
     environmental features  
 imprinting 138–61  
 improved oil recovery (IOR) 203  
 incentive structures 283  
 indeterminacy 211–41  
 India 2, 256–64, 265  
 indigenous peoples 95–6, 123  
 indirect costs 61  
 individual rationality 166, 173–4,  
 181–2  
 individual roles/effects studies 4–5, 7  
 inductive qualitative approach 120  
 industrialization 169  
 industry associations 103  
 industry level analyses 92–7  
 industry risk 106  
 inequality 285–8  
 innovation 51–2, 170, 198, 200, 202
- institutional-less codes of conduct  
     246–9  
 institutional legitimacy 246, 265  
 institutional rules, sustainability  
     252–3, 262–4  
 institutionalization, science 249, 264  
 institutions 7, 15–17, 79, 248–9, 273  
 intangible resources 11, 188, 189  
 intangible risk 194  
 integration, vertical 138–61  
 interaction complexity 77  
 interdependence 45, 55, 115–37, 214,  
 228, 235  
 International Oil Companies (IOCs)  
     151  
 international policies 48  
 interorganizational resources 4  
 interviews 121–2, 222–3  
 investments 62–3, 77–8, 150–151, 287  
 IOCs *see* International Oil Companies  
 IOR *see* improved oil recovery  
 irreversibility 211–41  
 issue framing 37
- Jennings, P.D. 170  
 Jevons, Stanley 187  
 joint ventures (JVs) 103
- Kale, S. 142  
 Kates, R.W. 250–251  
 King, Sir David 46  
 Kliesch-Eberl, M. 98–9  
 knowledge resources 144, 196  
 knowledge, scientific 245–6, 249–50,  
 252–3, 255, 262  
 Kuhn's paradigms 254
- land acquisitions 44  
 land competition 48  
 'land grabs' 14, 36  
 large companies 92–3, 97, 102  
 Latour, B. 170, 182, 212  
 Lavie, D. 144  
 LCA *see* life-cycle assessment  
 Lê, J.K. 170  
 leadership 21–2, 53–4, 284  
 Lee, B.H. 7, 45  
 legislation 155, 179  
 legitimacy 118, 130, 168, 249–53, 264  
 liability 142–3, 146

- life-cycle assessment (LCA) 66
- lifespans, water resources 181–2
- local actors 116–19, 130
- local drivers, resource nexus 40
- local resource arrangements 118–20
- local sustainability 251, 263
- local water challenges 256–60
- localness 47, 115–37
- loosely coupled networks 125
- low-carbon economy 61–87
  
- McArthur, A.W. 44
- McCloud River 167, 171–9, 180
- macro level analyses 89–91
- macro risks 194
- macro theories 237
- Madsen, P.M. 7
- Maitlis, S. 215
- Malthus, Thomas Robert 10, 37–8
- management challenges 61–87, 88, 92
- management innovation 198
- management mindsets 139–40, 146, 148, 151, 155
- management opportunities 61–87
- Marchington, M. 117
- Marcus, A.A. 7
- ‘market’ arrangements 128
- market competition 11
- market contexts 42–3, 167–70, 199–200
- market rationale, scarcity 10, 38
- market uncertainties 202
- Marquis, C. 142
- Martens, Phil 54
- Mathlener, R. 14
- Mayer, K.J. 151
- Means, G. 253
- measurement applications 260
- metals 2, 11
- metering 260, 275
- methanol-based olefins production technologies (MTO-technologies) 64, 68
- Meyer, J.W. 168
- micro theories 237
- micro threats 195
- microcredits 283
- Middleton, C.J. 39, 40
- Miles, M.B. 121
- mindsets *see* management mindsets
- minerals 2
- mining 14, 17, 42–3, 124, 144, 152, 198, 282
- Mitchell, W. 202, 203
- mitigation of financial risks 100–101
- modern resource markets 167–70
- Monbiot, G. 276, 282
- Mostafa, R. 141
- motives, sustainability 252, 262, 264
- MTO-technologies *see* methanol-based olefins production technologies
- Muir, John 173, 182
- ‘multiplex’ arrangements 128
- munificence 15, 35, 46–7, 50
- mutual dependence 118, 130
  
- narrow scope arrangements 125
- national borders 284, 289
- national oil company (NUNAOIL) 201
- national regulations 275–6
- nationalizations, finite resources 189
- natural environment
  - case studies 123–4
  - imprints 143–4
  - munificence 35
  - oil/gas industry 91
- ‘natural hedging’ 101
- natural imprinting 138–61
- natural resource base 200–201
- natural resource characteristics 140, 144, 146–54
- natural resource management, overview 1–32
- natural resource markets 167–70
- natural resource risk 94–5
- natural resources
  - keywords related to 4–10
  - studying 75
  - terminology 3
- natural systems 211–15, 217, 225, 233
- nature-inspired reasoning 280
- nature-society interactions 251
- Neath, Gavin 52
- negative-sum trade-offs 48–9
- Nestlé case 256–62, 265
- Neumayer, E. 253
- newness, liability of 142–3

- Newtonian dynamics 217  
nexus thinking 39–40, 41, 49–54  
*see also* resource nexus  
non-consumptive use, resources 116, 120  
non-energy minerals 2  
non-renewable resources 218  
*see also* finite natural resources  
non-substitutability 197–9  
non-sustainability 189  
normative legitimacy 250  
normative pillar, sustainability 249, 265  
normative reasoning 277, 280  
nuclear technology 16, 204  
NUNAOIL *see* national oil company  
Nystrom, P.C. 44
- observational methods 221–2  
oil commodity markets 88–111  
oil industry 203, 204  
  auto-consumption 196  
  emission rights 282  
  macro level analysis 89–91  
  reserve replacement ratio 189, 200–201  
  risk management 194–5  
  and scarcity 149  
Oil Service Companies (OSCs) 149, 151  
olefins 63–4, 66–8, 70, 79, 81  
Oliver, C. 273  
opaque markets 42, 53  
openness 52–3  
operating costs (OPEX) 66, 68  
operating permits 257–8, 262, 265  
operating system sustainability 251  
operational level, climate change 274, 276  
operationalization 155, 262–3  
OPEX *see* operating costs  
Oppenheim, Jeremy 44  
opportunism 149–50, 151, 195–6  
opportunities 61–87, 99–104, 115  
optimization opportunities 100  
organization theories 214  
organizational actorhood 165–85  
organizational ambidexterity 80–82  
organizational assets 4  
organizational breakdown 217  
organizational rationality 166, 167–9, 176–9  
organizational resilience 98  
organizational rules, resource nexus 46  
organizational structures 220  
organizations  
  dissipation processes 212–13  
  as environmental actors 167–9  
  frontlines of 211  
  global approach 170  
  irreversibility process 218  
  natural systems interaction 212  
  production process impacts 178  
  regulations 7  
  resource scarcity 14–15, 36  
OSCs *see* Oil Service Companies  
otherhood 168–9  
Ott, K. 253–4, 264  
‘owners’ of atmosphere 277–82  
ownership disputes 187  
Özcan, S. 4
- panchayat* council, India 257–8  
participant observation 222  
partnerships 103–4, 107  
patents 190, 194, 202, 203  
Patriotta, G. 216  
payment mechanisms 264  
people as resources 4  
  *see also* human resources  
per-capita redistribution 277–84, 289  
perfect immobility of resources 190  
permits for operating 257–8, 262, 265  
persistence, imprinting 146  
Pfeffer, J. 118  
physical assets 150–151  
physical science 245–6  
Pisano, G.P. 94–5  
Piskorski, M. 117–18  
planetary boundaries 38, 45, 47  
policy model, climate strategy 273–82  
political agenda 251, 279  
  *see also* socio-political factors  
political constraints 38, 39  
political interactions 76  
political-level terra-complexity 41  
political risk 97, 194–6, 199, 201–3, 205  
Popper’s falsification 254–5

- population growth 35, 89–90, 278–9, 284–5, 290–291  
 portfolio decisions 104–5, 108  
 potable water *see* drinking water  
 poverty 279, 288, 289, 290–291  
 Powell, E.E. 4  
 power and inequality 287  
 pragmatism, sustainability 22–3  
 precautionary principles 49  
 price differences 16, 198, 277–8  
 price drop risks 93  
 price hedging 101  
 price spikes 48  
 Priem, R.L. 187, 205  
 Prigogine, I. 212–13, 214, 217, 218, 236  
 private ownership 179, 272  
 problem framing 37  
 process adjustment, oil/gas industry 105  
 process innovation 198  
 process irreversibility 212  
 product innovation 198  
 profit motive 262  
 profitability 226  
 prominent environmental features 143–54  
 property rights 187, 189–96, 203  
 public acceptance, coal 74–5  
 public ownership 272  
 public–private partnerships 22  
 Quaschnig, V. 271  
 R&D *see* research and development  
 rare earth exchange 15  
 rare earth market 11, 14, 16  
 rationality 166–7, 171, 173–6, 180–181  
     *see also* organizational rationality  
 Raw Materials Strategy, Germany 17  
 raw materials transition 61–87  
 RBV *see* resource-based view  
 real options framework 78–80  
 reality 217  
 rebuilding perspectives 180–181  
 recalcitrant natural systems 212, 214  
 reciprocal relations 128  
 reconfiguration of capabilities 104–5  
 recycling aluminium 54  
 redistribution 277–82, 283–4, 289  
 regulations 7, 97, 180, 220–221, 236, 275–6  
 regulative legitimacy 250  
 regulative pillar, sustainability 249  
 ‘relational’ arrangements 127–8  
 relevant stakeholders 253, 263–5  
 relocation of resources 180–181  
 remoteness 145, 152  
 renewable resources 69, 204, 218  
 replenishing resources 181–2  
 research agenda 1–32  
 research and development (R&D) 101–2, 206  
 research questions 255–6  
 research systems 251  
 reserve replacement ratio (RRR) 189, 200–201  
 reservoirs 94–5, 175  
 resilience 50, 98  
 resource accessibility 144–5, 150–151  
 resource availability 37–8, 43, 147–9, 199–200  
 resource-based view (RBV) 3, 11, 153–4, 186–210  
 resource bundles 190–194  
 resource consumption 165–6  
 ‘resource curse’ 90  
 resource dependence 117–19  
 resource extraction 18, 42  
     *see also* extraction context;  
     extractive industries/sector  
 resource nexus 35–60  
 resource relocation 180–181  
 resource scarcity *see* scarcity  
 resources  
     definition 188–9  
     terminology 2–6  
     typologies 3–4  
 review of RBV literature 188–99  
 Ricardo, David 10, 37  
 rights holders 96  
 rights, water usage 265  
 risk/risk management 78–80  
     capabilities for 97–105  
     corporations 168  
     oil/gas commodity markets 88–111  
     organizational rationality 169  
     ownership disputes 187  
     property rights 194–6



- risk-seeking 50  
 rivers 167, 169–81  
 Rojas, F. 3–4  
 role perspectives 43  
 Roulet, A. 21–2  
 RRR *see* reserve replacement ratio  
 Rugman, A.M. 99
- Salancik, G.R. 118  
 Sangchan, P. 7  
 scale perspectives 43  
 scarcity 3, 35–60, 197  
   definition 10  
   drinking water 1  
   framing in time 36–41  
   managerial implications 11–19  
   organizational responses 14–15  
   reasons for 10–11  
   in resource nexus 40–49  
   social impacts 18–19  
   supply of resources 190  
   and sustainability 19–23  
   and vertical integration 148–9, 155  
 scenario methods 99–100, 199–204  
 Schilling, M.A. 139  
 Schoolderman, H. 14  
 Schreyoff, G. 98–9  
 scientific methods 245–70  
 scope dimension, arrangements 125, 126  
 Scott, W.R. 40, 45–6, 53, 248–9  
 semi-structured interviews 222–3  
 sensemaking 211–41  
 sensitive periods, imprinting 142–3  
 Shasta Dam, McCloud River 175, 177–9  
 Silverstein, Shel 165–85  
 Simsek, Z. 142–3, 145–6  
 sink resources 41–2, 45–9, 54–5  
 small firms 93, 102  
   *see also* entrepreneurs  
 small scale experimentation 49  
 smallness, liability of 143  
 social constructions 170  
 social dimension, arrangements 125–6  
 social elements, sustainability 271–92  
 social entrepreneurship 15  
 social impacts of resources 18–19  
 social learning 251  
 social mechanisms 38  
 social risk 96  
 social science 246  
 social, technological, economic, environmental and political (STEEP) factors 71–2  
 societal resources 4  
 socio-ecological systems 119, 122  
 socio-political factors 43, 46–7, 90–91  
 Sonenshein, S.K. 20  
 Sorrell, Sir Martin 40  
 source resources 41, 43, 47–9  
 spatial indeterminacy 229  
 specialization 51, 152  
 stage-gate processes 102  
 stakeholders 96, 102, 252–3, 259–60, 263–5  
 standards 77, 247  
 state ownership 92  
 Steensma, H.K. 139  
 STEEP factors *see* social, technological, economic, environmental and political factors  
 Stigler, G.J. 140–141  
 Stinchcombe, A.L. 142  
 Stone, Livingston 173–4  
 storytelling 224–5, 232  
 strategic ambidexterity 202, 203–4  
 strategic decision making 62–3, 138, 139, 155  
 structural ambidexterity 81  
 structural choices 138  
 structural dimension, arrangements 125, 127  
 substitution of technology 20–21  
 sufficiency principle 273–5  
 supplier threats 93–4, 101  
 supply chain 11, 140, 146–9  
 supply networks 51  
 supply scarcity 190  
 supply security 61–87  
 sustainability 22–3, 54  
   balancing for 102–3  
   benefits of 252, 260–261, 264  
   competitiveness 61–87  
   definition 251  
   ecological/entrepreneurial 271–92  
   extractive industries 218  
   local use of resources 131  
   organizational rationality 178

- resource consumption 166
- resource exploitation 115
  - and scarcity 2, 19–23
  - social construction 170
  - social elements 271–92
- sustainability science 245–70
- sustainable development pillars 248
- Svalbard case 123–4, 125, 126–7
- symbiotic collective action 52–3
- systems behaviour 38, 217
  - see also* natural systems
- systems thinking 41
  
- Taleb, Nassim 50, 51
- tangible resources 11, 188, 189
- tangible risk 194
- TCE *see* transaction costs economics
- technical uncertainties 202
- techno-economic constraints 37, 42, 45, 47
- techno-economic-environmental evaluations 64–8, 70
- technology
  - adoption 20–21
  - availability 252–3, 260, 264–5
  - development 200
  - investment in 81–2, 101–3
  - substitution 20–21
- technology exchange 16–17
- technology patents 190, 194, 203
- technology risk 94
- temporal indeterminacy 228–9
- Teng Lit Liak 19–23
- TERI *see* The Energy and Resources Institute
- terra-complexity 41
- The Energy and Resources Institute (TERI) 258, 263–4
- thermodynamics law 197, 212, 217
- third-party agents 263–4
- threats 99–104
- Tilcsik, A. 142
- time frame, scarcity 36–41
- time irreversibility 212, 226
- Tober, J.A. 10, 38
- tourism 121, 124, 126, 130
- trading emissions 274, 276, 280, 288
- ‘tragedy of the commons’ 272–3
- transaction costs 141, 190, 195–6
  - transaction costs economics (TCE) 138–40, 149, 153
- transportation factors 90, 174
- trawl fishing industry 211–41
- trust relations 130
- Tushman, M.L. 45
  
- UN *see* United Nations
- uncertainty 78–80
  - access arrangements 130
  - food supply 1, 48
  - government intervention 17
  - innovation 202
  - political risk 196
  - raw materials system 75
  - resource nexus 44–5, 47, 49–50
  - stage-gate processes 102
  - systems behaviour 38
- United Nations Global Compact (UNGC) 246–7, 249, 264–5
- United Nations (UN) 276, 280, 284
- upstream approach, immissions 274–5, 288
- upstream integration 148
- urban mining 14, 198
- usage rights, commons 272–3
  
- valuable, rare, inimitable and non-substitutable (VRIN) resources 187, 189–90
- value chain 282, 290
- value creation 102, 205
- value, emission rights 276, 278
- Verbeke, A. 99
- vertical integration 138–61
- Villamayor-Tomas, S. 41
- Vincent, S. 117
- violated expectations 215–16
- voluntary codes of conduct 246–56, 264
- Voser, Peter 53
- VRIN resources *see* valuable, rare, inimitable and non-substitutable resources
  
- Walras, L. 272–3
- water, energy, food (WEF) agenda 39, 55
- water management 165–85
- water scarcity 1–2, 18–19, 52

- water technology 21
- water usage science 245–70
- wealth inequality 285–8
- WEF agenda *see* water, energy, food agenda
- Weick, K.E. 233
- Welford, R. 256
- Wernerfelt, B. 189
- Westlands Water District 176–7
- White, P. 52
- Whitehead, Alfred North 212
- Whiteman, G. 213–14
- Williamson, O.E. 141
- Wintu Indians 173–4, 178–9, 181
- World Trade Organization (WTO) 250
- Yin, R.K. 120, 255
- zero indeterminacy 232
- Ziedonis, R.H. 190
- Ziegler, R. 253–4, 264
- Zucker, D.M. 255

