

INDEX

- AbbVie, 221
- Abreu, M., 169
- Absorptive capacity of firms
commercialization of IP and, 11
knowledge transfer and, 38, 267
in mode 1 conception of knowledge transfer, 363
- Academics
professor's privilege, abolition of, 7, 41, 69, 163, 199–205, 397, 403
surveys of, 429–430, 436–439, 461–462
- Africa. *See also specific country*
blockchain technology in, 455
measurement challenges in, 454–455
metrics of knowledge transfer in, 440, 452, 455
Strategy for Science, Technology and Innovation (STISA-24), 452–454
university knowledge transfer policies in, 8–9
- African Continental Free Trade Agreement (AfCFTA), 454
- African Innovation Outlook series, 454, 455
- African Observatory for Science, Technology and Innovation (AOSTI), 455
- Albuquerque, E., 38, 264, 269
- Alessandrini, M., 342
- Algeria, university knowledge transfer policy in, 8–9
- Amadei, J.R.P., 269–270
- Amazon, 349–350
- Anglo Platinum (South Africa), 343
- Annual reports, 462
- Argentina
channels of knowledge transfer in, 38
government funding of R&D in, 13
industry financing of R&D in, 48
structural challenges for public R&D in, 16
- Arque-Castells, P., 364
- Arundel, Anthony, 59, 398, 452, 453, 455, 459, 461–462
- Arza, V., 265
- Asia. *See also specific country*
metrics of knowledge transfer in, 440
university knowledge transfer policies in, 7, 8
- Association of University Technology Managers (AUTM)
Better World Project, 75, 444–445
IP licensing model, metrics for, 53, 56, 59
Licensing Activity Survey, 73
metrics of knowledge transfer and, 426–427, 444
questionnaire, 350
surveys of KTOs, 73
- ASTP, 426, 458, 459
- Australia
surveys of KTOs in, 53
university, patent filings by, 114
- Austria
pre-emption rights principle in, 154–155
professor's privilege, abolition of, 7, 397
- Axel patent, 395
- Ballard (Canada), 343
- Bangladesh, university knowledge transfer policy in, 8
- BASF, 221
- Belgium, metrics of knowledge transfer in, 436

- “Big data,” 441–442
- BioMed X Innovation Center, 220–221
- Biotechnology, patent filings in, 109–112
- Block, F., 396
- Blockchain technology, 455
- Böhringer-Ingelheim, 221
- Bolivia, government funding of R&D in, 13
- Bordoy, C., 59
- Brazil
 - Brazilian Agriculture Research Corporation (Embrapa), 270, 277
 - Brazilian Centre for Research in Energy and Materials (CNPq), 279–280
 - Brazilian Innovation Survey, 282
 - Brazilian National Service for Industrial Training (SENAI), 282
 - Butantan Institute, 277–279
 - channels of knowledge transfer in, 38
 - collaborative research in, 267
 - Constitution, 419
 - consultancies in, 290–291, 293–294
 - Coordination for the Improvement of Higher Education Personnel (Capes) program, 273–275
 - CT-Infra, 273–275
 - education and training in, 265
 - Finep, 272
 - Good Law, 273
 - government funding of R&D in, 13
 - Greater Brazil Plan, 273
 - growth of public R&D in, 263–264
 - income level, patent filings by, 93, 106–107
 - Industrial, Technological and Foreign Trade Policy (PITCE), 273
 - Industrial Property Law 1996, 267, 269, 280
 - Innovate Company Program, 273
 - Innovation Act 2004, 267, 269, 272–273, 280–282, 284–287, 291, 293, 376, 408, 419, 420
 - Intellectual Property Law 1996, 284
 - Investment Maintenance Program (PSI), 273
 - ITec platform, 33
 - knowledge capabilities gap in, 368
 - knowledge transfer in
 - absorptive capacity of firms and, 267
 - bureaucratic issues, 271–272, 294–295
 - case study, 376
 - challenges of, 420–421
 - channels of, 287–291
 - consultancies and, 290–291, 293–294
 - cooperative agreements and, 282–284
 - demand-side incentives supporting, 408, 420
 - financial factors, 419–420
 - formal channels of, 287–290
 - funding and, 270–271
 - high level R&D, lack of, 265
 - incentives, 293
 - informal channels of, 266–267, 287
 - institutional factors, 419
 - institutional practices, 291–294
 - instruments, 274
 - legal framework of, 284–287
 - legislation patterned on Bayh-Dole Act in, 406–407
 - non-disclosure agreements and, 290
 - “open science” and, 266–267
 - overview, 22, 263–264, 294–295
 - patent licensing and, 287–290, 375–376
 - policies and practices, 274, 376
 - in “processing industry,” 265
 - by public research institutes, 270, 277–280
 - research agreements and, 290–291
 - spin-offs and, 266
 - supply-side incentives supporting, 410, 420
 - technological partnership agreements and, 290

- type of knowledge, correlation
 - with, 266
- by universities, 270
- university knowledge transfer
 - policy, 8
 - weakness of channels, 264
- KTOs in, 373
- legislation patterned on Bayh-Dole
 - Act in, 396, 419
- metrics of knowledge transfer in,
 - 426, 432–433
- Ministry of Agriculture, 277
- Ministry of Education, 273–275
- Ministry of Health, 277–279
- Ministry of Science, Technology,
 - Innovation and
 - Communication, 33, 273,
 - 287–290
- National Education and Research
 - Network (RNP), 280
- National Electric Energy Agency, 284
- National Institute for Pure and
 - Applied Mathematics
 - (IMPA), 280
- National Institute of Industrial
 - Property (INPI), 280, 294
- New Science, Technology and
 - Innovation Legal
 - Framework, 419
- Oil National Agency, 284
- Oswaldo Cruz Foundation, 277
- patent licensing in, 287–290,
 - 375–376
- patent metrics in, 86
- Productive Development Policy, 273
- public investment in science and
 - technology in, 273–275
- public research institutes
 - collaboration with industry, 405
 - consultancies and, 293–294
 - cooperative agreements and,
 - 282–284
 - innovation and, 282–284
 - knowledge transfer by, 270,
 - 277–280
 - KTOs in, 267, 285–286,
 - 291–293, 294
 - non-financial compensation, 294
 - number of, 276
 - patent filings by, 280–282
 - revenues of, 279
- rationale for inclusion in study,
 - 18–21
- R&D/GDP ratio in, 25–26
- research infrastructure in, 273–276
- research publications in, 266, 287
- Science and Technology Act 2016,
 - 284–285, 286
- Sectoral Funds, 263, 269, 272
- seminars in, 266
- specialization of innovation in, 27
- Telecom Research and Development
 - Center, 282
- “two-way flow” of ideas in, 418
- universities
 - bureaucratic issues, 271–272,
 - 294–295
 - collaboration with industry, 398,
 - 405–406
 - consultancies and, 290–291,
 - 293–294
 - cooperative agreements and,
 - 282–284
 - fragility of linkages with industry,
 - 265, 269
 - funding and, 270–271
 - increase in interaction with
 - industry, 265
 - innovation and, 282–284
 - knowledge transfer by, 270
 - knowledge transfer policy, 8
 - KTOs in, 267, 268, 285–286,
 - 291–293, 294, 408
 - low level of interaction with
 - industry, 264–265
 - non-financial compensation, 294
 - number of, 276
 - patent filings by, 267, 268–270,
 - 280–282, 295
 - patent licensing and, 410
 - public research universities,
 - 276–277
 - research agreements and, 290–291
 - technological problems and, 270
- Brehm, S., 312–313
- Breschi, S., 342–344

- Bristol-Meyers-Squibb, 395
 Brito Cruz, C.H., 265
 Britto, G., 264–265
 Burkina Faso, government funding of R&D in, 13
- Cai, Y.Z., 321
 Cambridge Inventor-Ownership Model, 171
 Cambridge University, 142, 149, 163, 397, 404
 Cameron, William Bruce, 78
 Campbell, D.F.G., 364
- Canada
 Canada Intellectual Property Office (CIPO), 128–131
 IP office, patent filings by, 131–132
 metrics of knowledge transfer in, 426–427
 national and institutional policies and practices supporting knowledge transfer in, 40
 surveys of KTOs in, 53, 56
 Canon, 114–128
 Cappelli, R.D., 219
 Caryannis, E.G., 364
 Central South University of Forestry and Technology (China), 308
 Centre for European Economic Research (ZEW), 191, 209
 Chan, K.W., 366, 367
 Changzhou University, 308
- Channels of knowledge transfer, 36–39
 collaborative research, 364–365, 368–369, 380, 460
 consultancies, 38, 290–291, 293–294, 341, 380, 398–400, 460
 contracts, 38, 50–52, 380, 439–440, 460
 education and training, 398–400, 460
 formal channels, 36–37, 38–39, 50–52, 76, 372, 443, 445, 446
 hiring of university graduates, 36
 informal channels, 36–37, 38–39, 50–52, 76, 372, 445
 “open science,” 50–52, 169, 266–267, 439–440
 patent licensing, 398–400
 research publications, 303, 398–400
 seminars, 209, 266, 267, 287, 398–400
 spin-offs as, 217–218, 243, 266, 309, 398–400
- Chaves, C.V., 265, 269
 Chemical engineering, patent filings in, 111
 Chemistry, patent filings in, 108, 109
 Chile, metrics of knowledge transfer in, 436
- China
 Central Committee of Communist Party of China, 300
 channels of knowledge transfer in, 38
 China Academy of Telecommunication Technology, 111
 Chinese Patent Office, 26–27
 Chinese Science Academy, 308
 collaborative research in, 313
 Company Law, 306, 323
 Contract Law, 306, 323
 Decision on Reforming the Science and Technology System, 300
 Drug Research Institution, 308
 European Union compared, 300
 government funding of R&D in, 13
 income level, patent filings by, 93, 95, 97, 103, 105, 106–107
 industry financing of R&D in, 48
 Innovation Centers, 310
 innovation in, 300
 investment in R&D, 301–302
 IP office, patent filings by, 131–132
 ITC, 26–27
 knowledge capabilities gap in, 368
 knowledge transfer in
 ambiguous corporate governance and regulation as barrier to, 322–323
 barriers to, 299–300, 321–323
 case study, 377–378
 immaturity of technology market as barrier to, 321–322
 increased rewards and compensation, 308
 Innovation Centers and, 310

- KTOs, 308
- lack of financial support as barrier to, 322
- legal framework, 304–306
- legislation patterned on Bayh-Dole Act in, 406–407
- marketing of information, 309
- overview, 22, 299–300, 323–324
- performance evaluation systems, 308
- policies and practices, 377–378
- policies promoting, 307–311
 - in provinces, 307
 - by public research institutes, 306–307
 - science parks and, 310–311, 320–321
 - spin-offs and, 309
 - strategic alliances for innovation and, 310
 - transaction costs as barrier to, 323
 - by universities, 306–307
- Law of Higher Education 1998, 301
- Law on Promoting the Transformation of Scientific and Technological Achievements (PTSTA), 299, 305–306, 323–324, 378
 - 2015 amendments, 306–311, 322, 378
- metrics of knowledge transfer in, 426, 427, 428, 432–433
- Ministry of Commerce, 313
- Ministry of Education, 301
- Ministry of Finance, 306, 378
- Ministry of Industry and Information, 310
- National High-Speed Train Technology Innovation Center, 310
- National Outline for Educational Reform and Development, 301
- National Plan for Medium and Long-Term S&T Development, 301
- National Science and Technology Plan, 310
- National Technology Transfer Center, 308
- National Technology Transfer Demonstration Institution, 308
- 985 Project, 301, 323
- OECD countries compared, 300
- patent applications in, 303–304
- Patent Law 1984, 305, 323
- patent licensing in, 313–320
- patent metrics in, 86
- Patent Office, 305
- patent sales or assignments in, 313–320
- Program on Promoting Scientific and Technological Achievements, Transfer and Transformation, 307
- public R&D, 300
- public research institutes
 - collaboration with industry, 309–310, 405
 - IP and, 306
 - knowledge transfer by, 306–307
 - KTOs in, 308
 - patent exploitation rates, 316–318
 - patent filings by, 128
 - patent licensing by, 314–316, 320
 - patent sales or assignments by, 318–319
 - role in R&D, 300–301
- rationale for inclusion in study, 18–21
- R&D/GDP ratio in, 25–26
- recruitment policies of KTOs, 413
- research publications in, 303
- Science and Technology Progress Law 2007, 304, 323
- science parks in, 310–311, 320–321
- State Intellectual Property Office of China (SIPO), 128–131, 303–304, 444
- State-Owned Asset Supervision and Administration Commission, 306
- strategic alliances for innovation, 310
- Strategy of Invigorating China through Science and Education, 301

- China (cont.)
 technology market in, 311–312
 Tongji University Creative Cluster, 321
 Torch Program, 310
 TusPark, 320
 211 Project, 301, 323
 universities
 collaboration with industry, 309–310, 311, 312–313, 398, 405–406
 IP and, 306
 knowledge transfer by, 306–307
 knowledge transfer policy, 8
 KTOs in, 308
 leaves of absence in, 309
 ownership of patents, 410
 patent exploitation rates, 316–318
 patent filings by, 128, 314
 patent licensing by, 314–316, 320
 patent sales or assignments by, 314, 318–319
 role in R&D, 300–301
 in WIPO, 305
 Xi'an S&T Market, 312
 Zhangjiang Hi-Tech Park, 321
 Zhejiang Online Technology Market, 312
 Zhongguancun Science Park, 320–321
- Cho, H.-D., 240–242
 Closs, L.Q., 270–271
 Cohen-Boyer patents, 55, 395
 Collaborative research. *See also specific country*
 in Brazil, 267
 as channel of knowledge transfer, 380, 460
 as channels of knowledge transfer, 364–365, 368–369
 in China, 313
 firms and, 372
 in Germany, 219
 IP licensing model and, 387–388
 in Korea, 248, 249, 251
 metrics of knowledge transfer and, 52, 428–429, 430–431
 public research institutes and, 372
 in South Africa, 349
 in United Kingdom, 149, 154
- Colombia
 income level, patent filings by, 93
 public research institute, patent filings by, 114
 universities
 knowledge transfer policy, 8
 patent filings by, 114
- Columbia University, 395
 Comin, D., 219–220
 Commercialization of IP. *See also specific country*
 conflicts regarding, 9–11
 decline of public research institutes and, 10–11
 diversification of, 411
 effect on funding, 9–10
 firms, absorptive capacity of, 11
 incentives for, 69
 lack of opportunities in middle-income countries, 413
 Mertonian norms and, 10
 metrics of knowledge transfer and, 55–56
 patent protection policies and, 81
 socially responsible research commercialization, 32–33, 34
 universities and, 398
- Community engagement, 361
 Company S (Korea), 247–249, 251
 Computer technology, patent filings in, 111
- Conceptual framework of knowledge transfer
 channels of knowledge transfer, 36–39
 downstream outcomes and, 69
 financial benefits, profits distinguished, 68–69
 formal channels of knowledge transfer, 36–37, 38–39, 76
 hiring of university graduates and, 36
 incentives for investor involvement and commercialization and, 69
 informal channels of knowledge transfer, 36–37, 38–39, 76

- overview, 21, 35–36
 patents, differing impact on research incentives and, 69–70
- Consultancies. *See also specific country*
 in Brazil, 290–291
 in Brazil, 293–294
 as channel of knowledge transfer, 38, 290–291, 293–294, 341, 380, 398–400, 460
 in Korea, 249
 metrics of knowledge transfer and, 50–52, 430–431, 460
 in South Africa, 341
 in United Kingdom, 174
- Contracts. *See also specific country*
 as channel of knowledge transfer, 38, 50–52, 380, 439–440, 460
 in Germany, 219
 in Korea, 251
 metrics of knowledge transfer and, 50–52, 428–429, 430–431
 in South Africa, 341
 in United Kingdom, 154, 414
- Convergence of knowledge transfer policies and practices, 393–394, 397–398, 413–415
- Cooper, D., 338
- Costa Rica
 channels of knowledge transfer in, 38
 university knowledge transfer policy in, 8
- Criscuolo, P., 366, 367
- Cross-country trends in public R&D, 11–13
- Cuntz, A., 200, 205
- Cusmano, L., 341, 343–344
- Czarnitzki, Dirk, 191, 200–206, 209, 215, 216–218
- Czech Republic
 pre-emption rights principle in, 154–155
 university ownership of patents in, 397
- de Castro, P.G., 266, 267
- Declaration on the Fourth Industrial Revolution, 454–455
- Demand pull firms, 374
- De Negri, F., 263, 265, 275–276
- Denmark
 Danish Agency for Science, Technology and Innovation (DASTI), 426
 metrics of knowledge transfer in, 426
 Ministry of Higher Education in Science, 426
 pre-emption rights principle in, 154–155
 professor's privilege, abolition of, 7, 397
- De Wet, G., 339
- Digital communications, patent filings in, 111
- Distell Group (South Africa), 343–344
- Dos Santos, M.E.R., 267
- Dutrénit, G., 265
- Economic growth as rationale for public R&D, 5
- Edler, J., 191
- Education and training. *See also specific country*
 in Brazil, 265
 as channel of knowledge transfer, 398–400, 460
 in Korea, 249
 in middle-income countries, 405–406
 public R&D and, 4
 in South Africa, 335, 337, 340–341
 in United Kingdom, 174
 WIPO university applicant names, verifying accuracy of, 137
- Egypt
 universities
 knowledge transfer policy, 8–9
 patent filings by, 114
- Electrical engineering, patent filings in, 108, 109
- Eom, B.-Y., 228, 258
- Equifinality, 362
- Es-Sadki, Nordine, 452, 453, 455, 459, 461–462
- European Commission
 Commission's Competence Centre on Technology Transfer (CC TT), 458

- European Commission (cont.)
 Expert Group on KT Metrics, 458
 Expert Group on Metrics for Knowledge Transfer, 458–459
 Joint Research Centre, 458
 National Associations Advisory Committee (NAAC), 458
 European Molecular Biology Laboratory (EMBL), 220
 “European paradox,” 457
 European Union. *See also specific country*
 China compared, 300
 Community Innovation Surveys (CIS), 195, 344, 345, 440, 453–454
 European Patent Office (EPO), 81–82, 128–131
 KTOs in, 457–458, 459
 metrics of knowledge transfer in, 457–459
 Multiannual Financial Framework (MFF), 457
 PATSTAT database (*See PATSTAT database*)
 surveys of KTOs in, 53, 56
 university knowledge transfer policies in, 7
 Eurostat, 345
- Fedderke, J.W., 338
 Ferreira, G.C., 270–271
 Financial incentives
 firms and, 372
 for investor involvement and commercialization, 69
 in middle-income countries, 394
 for participation in knowledge transfer, 31–32, 34
 public research institutes and, 372
 for universities, 412
 Finland
 pre-emption rights principle in, 154–155
 professor’s privilege in, 7
 Firms. *See also specific firm*
 barriers to knowledge transfer, 372–373
 characteristics of, 374
 collaborative research and, 372
 commercialization of IP and absorptive capacity of, 11
 demand pull firms, 374
 financial incentives and, 372
 knowledge capabilities gap and, 366–369, 380
 knowledge transfer and absorptive capacity of, 38, 267
 linkage with public research institutes, 371–372, 380–381
 mode 1 conception of knowledge transfer, absorptive capacity in, 363
 patent licensing and, 381
 policies and practices of, 22, 374
 R&D intensity of, 38
 successful knowledge transfer policies and practices, 369–371
 surveys of, 429–430, 439–441, 461–462
 Firm survivor bias, 218
 Florida State University, 395
 Fongwa, N.S., 339
 Foreign-oriented patent filings, 90–92
 Formal channels of knowledge transfer, 36–37, 38–39, 50–52, 76, 372, 443, 445, 446
- France
 Centre National de la Recherche Scientifique (CNRS), 111–112
 Commissariat à l’Energie Atomique et aux Energies Alternatives (CEA), 111, 114
 income level, patent filings by, 93, 97, 104, 106
 Institut national de la santé et de la recherche médicale (INSERM), 111, 128
 IP office, patent filings by, 131–132
 public research institute, patent filings by, 114, 128
 universities
 ownership of patents, 397
 patent filings by, 128

- patenting activities of, 155
 Freeman, Christopher, 4, 226
 Freitas, I.M.B., 429
 Friedman, J., 256
 Friedrich-Schiller-University, 220, 221
 Fudan University, 322
- Germany
 CarLa Catalytics Research Lab, 222
 collaborative research in, 219
 commercialization of IP in, 393–394
 contracts in, 219
 demand pull in, 365
 displacement effects in, 413–414
 EXIST program, 208
 Federal Ministry of Economics (BMWi), 205
 Federal Ministry of Education and Research (BMBF), 183–184, 196–199, 205
 Federal Statistical Office, 183
 Fraunhofer Association, 111, 114, 182, 183, 185, 186–187, 191–193, 195, 196, 209, 213, 219–220, 221, 361, 365
 German Cancer Research Institute, 220
 German Meteorological Office (DWD), 193
 German National Account, 218
 German Patent and Trademark Office (DPMA), 200
 German University Excellence Initiative, 206–207, 222
 Helmholtz Association, 182, 183, 184–185, 186–187, 195, 198, 209, 213, 365
 Helmholtz Centre for Research on Environmental Health, 221
 Helmholtz Institute, 221
 Helmholtz Society, 220
 income level, patent filings by, 93, 97
 InnovationLab, 222
 Innovative Hochschule scheme, 208
 IP office, patent filings by, 131–132
 knowledge capabilities gap in, 368
 “Knowledge Creates Markets” campaign, 196–199, 205
- knowledge transfer in
 benefits to business of, 217–220
 case study, 379–380
 changes in, 196–199
 channels of, 209–214
 economic literature on, 214
 funding schemes, 206–208
 historical background, 185–187
 innovation, effect on, 219
 job creation, effect on, 218–219
 leading users of, 195–196
 legislation patterned on Bayh-Dole Act in, 404
 limitations to, 215–217
 opportunity cost of, 215–217
 overview, 22, 182–183, 223–224
 patent valorization agencies, 205–206
 policies and practices, 378–379, 403
 by public research institutes, 191–195
 spin-offs, effect on, 217–218
 supporting interviews, 220–223
 by universities, 187–191, 220–223
- Leibniz Association, 182, 183, 185, 192–195, 198, 209, 213, 365
 Max Planck Association, 182, 183, 184–185, 186–187, 191–193, 195, 196, 209, 213, 221, 365
 Max Planck Institute for Medical Research, 220
 metrics of knowledge transfer in, 426, 432–433, 436
 Ministry of Health, 193
 Ministry of Transport and Digital Infrastructure, 193
 National Center for Tumor Diseases Heidelberg, 220
 patent licensing in, 393–394
 patent metrics in, 86
 patent valorization agencies, 205–206
 pre-emption rights principle in, 154–155
 professor’s privilege, abolition of, 7, 41, 163, 199–205, 397, 403

- Germany (cont.)
 public research institutes
 channels of knowledge transfer in, 209–214
 expenditures by, 183–185
 knowledge transfer by, 191–195
 overview, 182
 patent filings by, 128
 rationale for inclusion in study, 18–21
 R&D/GDP ratio in, 25–26
 research publications in, 219
 Robert Koch Institute, 193
 SIGNO program, 205
Spitzencluster initiative, 207, 222
 universities
 channels of knowledge transfer in, 209–214
 expenditures by, 184
 knowledge transfer by, 187–191, 220–223
 overview, 182
 patent filings by, 200–205, 403
 statistics on, 183
 supporting interviews, 220–223
- Geuna, A., 432
- Ghana, university knowledge transfer policy in, 8
- Gibbons, M., 362–363
- Goldberg, I., 338
- Government funding of R&D, 12–13
- Graff, G.D., 396
- Greece, pre-emption rights principle in, 154–155
- Haas, M.R., 366
- Harbin Institute of Technology, 128
- Harvard University, 112
- Hendry, John, 149
- High-income countries. *See also specific country*
 challenges for public R&D in, 17–18
 convergence of knowledge transfer policies and practices in, 393, 413–415
 demand-side incentives supporting knowledge transfer in, 407–411
 displacement effects in, 411–412, 413–414
 diversification of knowledge transfer policy in, 411–412
 firms, linkage with public research institutes and universities, 402
 ideal knowledge transfer policy mix, 411–413
 income level, patent filings by, 93–107
 knowledge transfer policies and practices in, 402–404
 legislation patterned on Bayh-Dole Act in, 413–415
 metrics of knowledge transfer in, 440
 middle-income countries, knowledge transfer compared, 400–402
 public research institutes, linkage with firms and universities, 402
 supply-side incentives supporting knowledge transfer in, 407–411
 timing and sequence of knowledge transfer policy changes, 410
 universities, linkage with firms and public research institutes, 402
- Huang, Can, 300
- Hunan University of Chinese Medicine, 308
- Hungary
 pre-emption rights principle in, 154–155
 university ownership of patents in, 397
- Huya Bioscience International, 322
- Hvide, Hans K., 69
- Hybrid Model, 171
- Impala Platinum (South Africa), 343
- Income level, patent filings by, 92–93
- India
 Council for Scientific and Industrial Research (CSIR), 413
 Department of Science and Technology, 461
 government funding of R&D in, 13
 income level, patent filings by, 93, 100–101, 106–107

- IP office, patent filings by, 131–132
 legislation patterned on Bayh-Dole Act in, 396
 metrics of knowledge transfer in, 461
 National Knowledge Commission, 395
 public research institute, patent filings by, 114
 university knowledge transfer policy in, 8
- Indonesia, university knowledge transfer policy in, 8
- Industry. *See* Firms
- Informal channels of knowledge transfer, 36–37, 38–39, 50–52, 76, 372, 445
- Initech (Korea), 244, 247, 251
- Innovation
 IP licensing model, stifling effects of, 47–48
 patents, effect of, 82
 as rationale for public R&D, 4–5
- International Property Rights Index (IPRI), 252
- Invention patents, 303
- Investment in public R&D
 conflicts between old and new rationales for, 9–11
 economic growth as rationale for, 5
 innovation as rationale for, 4–5
 rationales for, 3–5, 21
 social rate of return of, 5
 trade-offs between old and new rationales, 9–11
- IP licensing model. *See also specific country*
 advantages of, 45–47
 alliances with industry and, 387–388
 as channel of knowledge transfer, 36, 39, 398–400
 collaborative research and, 387–388
 collection of knowledge transfer metrics, 53–56
 disadvantages of, 47–49
 as discouraging collaboration, 49
 division of revenues, 388
 indicators, 70–71
 innovation, stifling effects on, 47–48
 institutional policies and, 50
 KTO characteristics, metrics of, 60
 legislation and, 50
 low-income countries, disadvantages in, 46, 49
 metrics of knowledge transfer and, 52, 60, 78
 middle-income countries, disadvantages in, 46, 49
 minimizing costs of knowledge transfer, 49–50
 non-financial disadvantages of, 48
 open IP policies, 50
 patent valorization and, 205–206, 386–387
 public research institutions, effects on, 42–43
 research publications and, 47, 48
 restrictions on licensing, 49
 secondary benefits of, 47
 signaling function, 47
 socioeconomic effects of, 44–45
 standardized indicators, 59–60
 supplementary metrics from KTOs, 56, 57–58
 support of new industry, 45–46
 surveys of KTOs, 53–56
 tacit knowledge and, 387
 undue influence of industry and, 48
 universities, effects on, 42–43
- IP office, patent filings by, 128–132. *See also specific office*
- Ireland, metrics of knowledge transfer in, 436
- Israel
 income level, patent filings by, 106
 IP office, patent filings by, 131–132
 universities
 knowledge transfer policy, 6, 394
 patent filings by, 114
- Italy
 IP office, patent filings by, 131–132
 metrics of knowledge transfer in, 426, 436
 NetVal, 426
 professor's privilege in, 7
 universities

- Italy (cont.)
 ownership of patents, 397
 patenting activities of, 155
- Japan
 income level, patent filings by, 93, 99, 104
 IP office, patent filings by, 131–132
 Japan Patent Office (JPO), 128–131
 metrics of knowledge transfer in, 436
 public research institute, patent filings by, 128
 universities
 knowledge transfer policy, 7
 patent filings by, 128
- Jenoptik, 220
- Jiang, Y., 313
- Johns Hopkins University, 111, 112
- Jones, Benjamin F., 69
- Jongwanich, J., 321
- Jordan, legislation patterned on Bayh-Dole Act in, 396
- Kahn, M.J., 338
- Kaplan, D., 339, 341, 364
- Kenney, M., 47
- Kenya, M-PESA payment system, 455
- Kim, L.-S., 227, 235–236
- Kim, Sun-Young, 249, 250
- Knowledge capabilities gap, 366–369, 380
- Knowledge transfer. *See also specific country*
 barriers to, 372–373, 381
 best practices, 77
 channels of, 36–39
 conceptual framework of (*See* Conceptual framework of knowledge transfer)
 convergence of policies and practices, 393–394, 397–398, 413–415
 cultural factors, 418–419
 demand pull in, 364–365
 demand-side incentives supporting, 155–156, 407–411, 420
 downstream outcomes and, 69
 ecosystem, understanding of, 76
 enabling environment, importance of, 77
 financial benefits, profits distinguished, 68–69
 financial factors, 419–420
 flexibility of policies, 77
 formal channels of, 36–37, 38–39, 76, 372, 443, 445, 446
 geography and, 27–28
 high-income countries, policies and practices in, 402–404
 hiring of university graduates and, 36
 ideal policy mix, 411–413
 improved evidence for policy-making, 71–72
 incentives for investor involvement and commercialization and, 69
 incentives for participation in, 31–32, 34
 informal channels of, 36–37, 38–39, 76, 372, 445
 institutional factors, 419
 institutional policies and practices supporting, 40–41
 institutional versus national policies and practices, 374–375
 institutions and, 26–27
 IP licensing model (*See* IP licensing model)
 knowledge capabilities gap and, 366–369, 380
 linear model, 362–363, 365–366
 metrics of (*See* Metrics of knowledge transfer)
 mode 1 conception, 362–363, 365–366
 mode 2 conception, 363–364
 mode 3 conception, 364–365, 380
 national policies and practices supporting, 40–41
 national versus institutional policies and practices, 374–375
 overview, 21
 patent metrics (*See* Patent metrics)
 patents, differing impact on research incentives and, 69–70
 policy priorities, 76–77
 public R&D in context of, 37

- questions regarding policies and practices, 414
- R&D/GDP ratio and, 25–26
- role of policies and practices in promoting, 39–40
- specialization of innovation and, 27
- startups and, 373
- structural characteristics of, 25–28
- successful policies and practices, 361–362, 369–371
- supply-side incentives supporting, 152–155, 407–411, 420
- systemic failures, heterogeneous remedies for, 28–29
- technology push and, 362–363
- timing and sequence of policy changes, 410
- “two-way flow” of ideas and, 418
- Knowledge transfer offices (KTOs)
 - characteristics of, 60, 373–374
 - improved evidence for policy-making and, 71–72
 - linear model of knowledge transfer and, 365–366
 - metrics of knowledge transfer
 - characteristics, metrics of, 60
 - data from, 430–431
 - metrics regarding, 73–75
 - policies and practices supporting knowledge transfer, 431–436
 - surveys of, 53–56
 - metrics regarding, 60, 73–75
 - mode 1 conception of knowledge transfer and, 365–366
 - nexus function of, 73–74
 - overview, 35
 - policies and practices of, 373–374
 - in public research institutes, 35
 - recruitment policies, 413
 - return on investment (ROI) of, 74–75
 - revenue and, 74–75
 - role of policies and practices in promoting knowledge transfer, 39
 - standardized indicators, 59–60
 - supplementary metrics from, 56, 57–58
 - surveys of, 53–56, 73, 428–429, 461–462
 - in universities, 35
- Kochenkova, A., 55
- Kolmar BNH (Korea), 246–247, 251
- Kolmar Korea, 245, 246, 247
- Korea, Republic of
 - Act on the Promotion of Industrial Education and Industry-University Collaboration 2003, 227, 229
 - collaborative research in, 248, 249, 251
 - commercialization of IP, efficiency of, 233–236
 - Connect Korea project, 230
 - consultancies in, 249
 - contracts in, 251
 - education and training in, 249
 - ETRI, 244–245
 - goals of patent system in, 424
 - government-funded non-practicing entities (NPEs), 250–251
 - Hub University for Industrial Collaboration (HUNIC) project, 230
 - income level, patent filings by, 93, 97, 100, 104, 106
 - Intellectual Discovery (ID), 250–251, 252
 - IP office, patent filings by, 131–132
 - knowledge capabilities gap in, 368
 - knowledge transfer in
 - case study, 376–377
 - challenges relating to public research institutes, 255–256
 - channels of knowledge transfer generally, 238–242, 258
 - collaborative R&D and, 248, 258
 - contracts, 251
 - expenditures on public R&D, 231–233
 - foreign firms and, 238
 - formal channels of, 242–244
 - government-funded non-practicing entities (NPEs) and, 250–251

- Korea, Republic of (cont.)
 graduate students, hiring of, 250
 immature government capabilities
 as challenge, 253, 258–259
 important factors in, 251–252
 informal channels of,
 247–250, 258
 innovation, effect on, 238
 institutional challenges,
 252–253
 laboratory companies and,
 243–244
 license income and, 236
 methodology of survey on, 260
 national versus institutional
 policies and practices, 375
 new technologies and, 233
 overview, 22, 257–259
 patent licensing and, 242,
 244–245, 248, 375–376
 policies and practices,
 376–377, 404
 policies to improve, 228–231
 public key infrastructure (PKI)
 and, 244–245
 by public research institutes,
 248–249, 250, 257–258
 sector distribution of, 238
 seminars and, 247–248
 SMEs, challenges relating to,
 253–255
 spin-offs and, 243
 startups and, 243–244, 245–247
 statistics, 231–238
 supporting interviews, 260
 by universities, 257–258
 university knowledge transfer
 policy, 7
 venture capital and, 249–250
- Korea Atomic Energy Research
 Institute (KAERI),
 245–247, 248
- Korea Institute for Advancement of
 Technology (KIAT),
 229–230, 260
- Korean Intellectual Property Office
 (KIPO), 128–131, 422
- Korea Technology Exchange, 229
- KTOs in, 373, 376–377
- Leaders in Industry-University
 Cooperation (LINC)
 project, 230
- Market-Driven IP and Technology
 Transfer Promotion Plan,
 230–231
- metrics of knowledge transfer in,
 426, 432–433
- Ministry of Food and Drug
 Safety, 246
- Ministry of Information and
 Communication, 244–245
- National Research Council of
 Science & Technology
 (NST), 243
- patent licensing in, 242, 244–245,
 248, 375–376
- patent metrics in, 86
- professors, startups and, 423
- public goods, public R&D as, 423
- public research institutes
 bureaucracy versus, 424
 challenges in knowledge transfer
 relating to, 255–256
 channels of knowledge transfer
 generally, 238–242
 collaboration with firms, 400,
 402, 411
 investments by, 229–230
 knowledge transfer by, 248–249,
 250, 257–258
 KTOs in, 228–229, 231, 255–256
 ownership of patents, 422,
 423–424
 patent filings by, 128, 233
 public R&D, role in, 226–227
 startups and, 422
 technology holding
 companies, 229
- rationale for inclusion in study,
 18–21
- R&D/GDP ratio in, 25–26
- Science and Technology Policy
 Institute (STEPI), 238
- small and medium-sized enterprises
 (SMEs) in, 228, 236–238,
 253–255, 377, 411, 424

- Special R&D Zone Promotion Act
2006, 243, 246
- Special Research Institute Promotion
Law 1973, 227
- Technology Transfer and
Commercialization Promotion
Act 2006, 229–230, 256, 422
- Technology Transfer Promotion Act
2000, 227, 228–229, 233, 246,
257, 376
- “twin dominance” of industry and
government in, 226, 228
- universities
channels of knowledge transfer
generally, 238–242
collaboration with firms, 411
knowledge transfer by, 257–258
knowledge transfer policy, 7
KTOs in, 227–229, 231
ownership of patents, 397, 422,
423–424
patent filings by, 128, 422–423
public R&D, limited role in,
226–228
sector distribution of knowledge
transfer by, 238
- Korea Electronics Telecomm, 111,
128
- Kotha, R., 366–367
- Kroll, H., 322
- Kruss, G., 338, 341
- KTOs. *See* Knowledge transfer offices
(KTOs)
- Kuriakose, S., 338
- Kwon, K.-S., 238
- Lan, X., 313
- Latin America. *See also specific country*
metrics of knowledge transfer in, 440
university knowledge transfer
policies in, 8
- Lee, Keun, 228, 258
- Legislation regarding university
knowledge transfer policies,
6–9, 80
- LG (Korea), 253–254
- Licensing of IP. *See* IP licensing model
- Liefner, I., 322
- Linear model of knowledge transfer,
362–363, 365–366
- Lissoni, F., 155
- Liu, C., 321
- Liu, H., 313
- Livesey, F., 266, 268
- Low-income countries. *See also specific
country*
basic economic needs as challenge
for public R&D in, 16
challenges for public R&D in, 14–18
heterogeneity as challenge for public
R&D in, 16
IP licensing model, disadvantages of,
46, 49
metrics of knowledge transfer in, 440
structural challenges for public R&D
in, 16–17
- Lubango, L.M., 342
- Ludwig-Maximilian University,
220, 221
- Lula da Silva, Luiz Inácio, 273
- Lundin, N., 312–313
- Lundvall, Bengt-Åke, 4
- Ma, J., 313
- Malaysia
channels of knowledge transfer in, 38
government funding of R&D in, 13
income level, patent filings by, 93,
102–103, 106–107
legislation patterned on Bayh-Dole
Act in, 396
public research institute, patent
filings by, 114
universities
knowledge transfer policy, 8
patent filings by, 114
- Malerba, F., 342–344
- Mannheim Innovation Panel (MIP),
195, 219
- Marais, L., 339
- Massachusetts Institute of Technology,
112, 282
- Materials, patent filings in, 109–111
- Mazzucato, Mariana, 391
- Measurement, patent filings in, 108,
109–111

- Medical technology, patent filings
in, 109
- Mello, J.M.C., 267
- Merck Serono, 221
- Mertonian norms, 10
- Metallurgy, patent filings in, 109–111
- Metrics of knowledge transfer. *See also specific country*
- academics, surveys of, 429–430, 436–439, 461–462
 - annual reports and, 462
 - benefits of knowledge transfer, 442–445
 - “big data,” 441–442
 - collaborative research and, 428–429, 430–431
 - collection of metrics for IP licensing model, 53–56
 - commercialization of IP and, 55–56
 - consultancies and, 50–52, 430–431, 460
 - contracts and, 50–52, 428–429, 430–431
 - cost-benefit analysis, 442–445, 462–463
 - costs of, 446
 - data collection, 78
 - data discrepancies, 462
 - disproportionate focus of, 78, 79
 - economic relevance of, 428
 - “European paradox,” 457
 - financial benefits of knowledge transfer, 443–444
 - firms, surveys of, 429–430, 439–441, 461–462
 - formal channels of knowledge transfer, 443, 445, 446
 - full functionality of knowledge transfer and, 427–428
 - Higher Education-Business and Community Interaction (HE-BCI) survey, 430–431
 - in high-income countries, 440
 - indicators, 70–71
 - informal channels of knowledge transfer, 445
 - institutional level, data collection at, 434–436, 445–446
 - international comparability of, 427
 - IP licensing model and, 52, 60, 78
 - KTOs
 - characteristics, metrics of, 60
 - data from, 430–431
 - metrics regarding, 73–75
 - policies and practices supporting knowledge transfer, 431–436
 - surveys of, 53–56, 461–462
 - limitations of, 428
 - in low-income countries, 440
 - in middle-income countries, 428, 440
 - non-financial benefits of knowledge transfer, 444–445
 - non-IP-mediated knowledge transfer, 347–349, 429, 452–454, 460–461
 - normalizing of data, 79
 - “open science,” 50–52, 439–440
 - overview, 21, 22, 35–36, 77–78, 79, 445–446
 - patent metrics (*See Patent metrics*)
 - publicly available data, 441–442
 - public research institutes
 - benefits of knowledge transfer to, 431
 - policies and practices supporting knowledge transfer, 431–436
 - surveys of, 461–462
 - reluctance to provide data, 462
 - research publications and, 441–442
 - standardized indicators, 59–60
 - supplementary metrics from KTOs, 56, 57–58
 - types of metrics, 425
 - universities
 - data from, 430–431
 - policies and practices supporting knowledge transfer, 431–436
 - value of measured activities, 427
 - “vanity” metrics, 78
 - WIPO Assessment Questionnaire for Stakeholders from Academic and Research Institutions, 464–474 (*See also* WIPO Assessment Questionnaire for

- Stakeholders from Academic and Research Institutions)
- Mexico
 channels of knowledge transfer in, 38
 government funding of R&D in, 13
 income level, patent filings by, 93, 102
 university knowledge transfer policy in, 8
- Middle-income countries. *See also specific country*
 basic economic needs as challenge for public R&D in, 16
 challenges for public R&D in, 14–18
 collaboration between universities and industry, 412–413
 convergence of knowledge transfer policies and practices in, 413–415
 demand-side incentives supporting knowledge transfer in, 407–411
 education and training in, 405–406
 financial incentives in, 394
 heterogeneity as challenge for public R&D in, 16
 high-income countries, knowledge transfer compared, 400–402
 ideal knowledge transfer policy mix, 411–413
 income level, patent filings by, 93–107
 IP licensing model, disadvantages of, 46, 49
 knowledge transfer policies and practices in, 405–407
 lack of commercialization opportunities in, 413
 lack of research capacity in universities, 412
 legislation patterned on Bayh-Dole Act in, 413–415
 metrics of knowledge transfer in, 428, 440
 public research institute knowledge transfer policy in, 394
 structural challenges for public R&D in, 16–17
 supply-side incentives supporting knowledge transfer in, 407–411
 timing and sequence of knowledge transfer policy changes, 410
 university knowledge transfer policy in, 394
- Miller, K., 364–365
- Mode 1 conception of knowledge transfer, 362–363, 365–366
- Mode 2 conception of knowledge transfer, 363–364
- Mode 3 conception of knowledge transfer, 364–365, 380
- Mondi (South Africa), 343
- Morocco
 income level, patent filings by, 93
 public research institute, patent filings by, 114
 universities
 knowledge transfer policy, 8–9
 patent filings by, 114
- M-PESA payment system, 455
- Munari, F., 374–375
- Munich Innovation Group, 187–188
- National technology exchanges, 374
- Nelson, Richard R., 4
- Netherlands, metrics of knowledge transfer in, 436
- New Zealand, surveys of KTOs in, 53
- Nigeria
 channels of knowledge transfer in, 38
 National Office for Technology Acquisition and Promotion (NOTAP), 8–9
 university knowledge transfer policy in, 8–9
- Non-IP-mediated knowledge transfer, metrics of, 347–349, 429, 452–454, 460–461
- Northwestern University, 128
- North-West University (South Africa), 349–350
- Norway
 metrics of knowledge transfer in, 436

- Norway (cont.)
 pre-emption rights principle in,
 154–155
 professor's privilege, abolition of, 7,
 69, 397
- Ok, J.-Y., 235–236
- Oliveira, P., 268–269
- Onderstepoort Biological Products
 (South Africa), 331
- Open IP policies, 50
- "Open science," 50–52, 169, 266–267,
 439–440
- Organic chemistry, patent filings
 in, 109
- Organisation for Economic Co-
 operation and Development
 (OECD), 300
- O'Shea, R.P., 364
- Oslo Manual, 430, 440
- Oxford Biomedica, 249
- PACEC, 154
- Pakistan, university knowledge transfer
 policy in, 8
- Panasonic, 114–128
- Paris Convention for the Protection of
 Industrial Property, 305
- Patent Cooperation Treaty (PCT)
 advantages of use in patent metrics
 and, 84
 as data source for patent metrics, 81,
 84–85, 132–134
 disadvantages of use in patent
 metrics and, 84–85
 identifying universities and public
 research institutes for purposes
 of patent metrics, 86–89
 income level, patent filings by,
 92–103
 South Africa and, 331–333, 349
 statistical trends in patent filings
 under, 90
 supplementary metrics regarding, 56
 technology field, patent filings by,
 108–109, 111
 university, patent filings by, 112–128
- Patent metrics
 academia, focus on, 81–82
 applicability to universities and
 public research institutes, 83
 data sources, 84–86
 foreign-oriented patent filings and,
 90–92
 identifying universities and public
 research institutes for purposes
 of, 86–89
 income level, patent filings by, 92–93
 individual patent holders, 82–83
 innovation, effect of patents on, 82
 IP office, patent filings by, 128–132
 lack of standardized information,
 86–87
 low-income countries, patent filings
 by income level in, 93–107
 middle-income countries, patent
 filings by income level in,
 93–107
 name-cleaning and, 87–88
 name-matching and, 88
 overview, 21, 80–81,
 132–134
 Patent Cooperation Treaty (PCT) as
 data source, 81, 132–134 (*See*
also Patent Cooperation
 Treaty (PCT))
 patent family definition and, 85,
 88–89
 PATSTAT database as data source,
 81, 132–134 (*See also* PATSTAT
 database)
 public R&D versus private
 R&D, 82
 public research institute, patent
 filings by, 114, 128
 quality checks, 89
 residence and, 89
 statistical trends in patent
 filings, 90
 technology field, patent filings by,
 107–112
 underestimation, 83
 university, patent filings by, 112–128
 WIPO university and public research
 institute applicant names,
 verifying accuracy of, 137

- Patents
- differing impact on research incentives, 69–70
 - goals of patent system, 424
 - invention patents, 303
 - resident versus non-resident applications, 280
 - valorization, 205–206, 386–387
- PATSTAT database
- advantages of use in patent metrics and, 85
 - as data source for patent metrics, 81, 85–86, 132–134
 - disadvantages of use in patent metrics and, 85
- Germany
- knowledge transfer in, 187–188
 - patent filings in, 200
- identifying universities and public research institutes for purposes of patent metrics, 86–89
- income level, patent filings by, 104–107
- quality checks in patent metrics, 89
- statistical trends in patent filings in, 90
- technology field, patent filings by, 109–111
- Patton, D., 47
- People's Republic of China. *See* China
- Pereira, F.C., 267
- Peru
- government funding of R&D in, 13
 - university knowledge transfer policy in, 8
- Phaho, D., 339
- Pharmaceuticals, patent filings in, 109–112
- Philippines
- government funding of R&D in, 13
 - public research institute, patent filings by, 114
 - universities
 - knowledge transfer policy, 8
 - patent filings by, 114
- Pinheiro-Machado, 268–269
- Poland, university ownership of patents in, 397
- Porto, G.S., 270, 271
- Portugal, failures of knowledge transfer in, 364
- Pouris, A., 339, 342
- Póvoa, L.M.C., 265, 266–267, 269, 270
- Private R&D, public R&D contrasted, 6, 82
- Professor's privilege, abolition of, 7, 41, 69, 163, 199–205, 397, 403
- Public goods, public R&D as, 4, 5, 423
- Public R&D
- commercialization of IP (*See* Commercialization of IP)
 - in context of knowledge transfer, 37
 - cross-country trends in, 11–13
 - economic growth as rationale for public R&D, 5
 - education and training and, 4
 - government funding of, 12–13
 - high-income countries, challenges in, 17–18
 - innovation as rationale for public R&D, 4–5
 - investment in (*See* Investment in public R&D)
 - low-income countries, challenges in, 14–18
 - middle-income countries, challenges in, 14–18
 - private R&D contrasted, 6, 82
 - as public good, 4, 5
 - socially responsible research commercialization, 32–33, 34
- Public research institutes. *See also specific country*
- barriers to knowledge transfer, 372–373
 - best practices, 381
 - collaborative research and, 372
 - decline of, 10–11
 - financial incentives and, 372
 - foreign-oriented patent filings by, 90–92
 - incentives for participation in knowledge transfer, 31–32, 34
 - income level, patent filings by, 92–93

- Public research institutes (cont.)
 IP licensing model, effect of, 42–43
 knowledge capabilities gap and, 380
 KTOs in, 35
 linkage with firms, 371–372, 380–381
 metrics of knowledge transfer
 benefits of knowledge transfer
 to, 431
 policies and practices supporting
 knowledge transfer, 431–436
 middle-income countries,
 knowledge transfer policy
 in, 394
 patent filings by public research
 institute, 114, 128 (*See also*
 specific institute)
 patent licensing and, 381
 patent metrics (*See* Patent metrics)
 questions regarding knowledge
 transfer policies and
 practices, 414
 role in public R&D, 12
 statistical trends in patent filings
 by, 90
 successful knowledge transfer
 policies and practices, 369–371
 surveys of, 461–462
 technology field, patent filings by,
 107–112
 WIPO applicant names, verifying
 accuracy of, 137
- QS World Ranking of Universities,
 188–191
- Quality checks in patent metrics, 89
- Quan, X.H., 311
- Ramaphosa, Cyril, 355
- Rammer, C., 191
- Rapini, M.S., 264–265, 266, 270, 271
- Rationales for investment in
 public R&D
 conflicts between old and new
 rationales, 9–11
 overview, 3–5, 21
 trade-offs between old and new
 rationales, 9–11
- Rauen, C.V., 271, 292, 293
- Ray, A.S., 172, 460–461
- rDNA, 395
- Research publications. *See also specific
 country*
 in Brazil, 266, 287
 as channel of knowledge transfer,
 303, 398–400
 in China, 303
 in Germany, 219
 IP licensing model and, 47, 48
 metrics of knowledge transfer and,
 441–442
 in South Africa, 347–349
 in United Kingdom, 169
 use as metrics, 59
- Return on investment (ROI) of KTOs,
 74–75
- Roche, 221
- Rogers, M., 171, 172
- Romania, government funding of R&D
 in, 13
- Rorwana, A., 342
- Rosli, A., 150
- Rossi, Federica, 150, 432
- Russian Federation
 government funding of R&D in, 13
 industry financing of R&D in, 48
 university knowledge transfer policy
 in, 7, 8
- Saha, S., 461
- Samsung, 253–254
- SAP, 221
- Sappi (South Africa), 343
- Sasol (South Africa), 343, 349–350, 368
- Schmoch, U., 191, 199–200
- Science Citation Index (SCI), 303
- Scimago Institutions Rankings World
 Report, 88
- Scopus (database), 88
- Seminars
 in Brazil, 266
 as channel of knowledge transfer,
 209, 266, 267, 287, 398–400
 in Korea, 247–248
- Sengupta, A., 172, 460–461
- Seoul National University,
 112–114, 236

- Shanghai Jiao Tong University, 128
- Shapiro, M.A., 50
- Shenzhen University, 114
- Sibanda, M., 338
- Siegel, D.S., 429
- Silberman, J., 256
- Silicon Valley, 396–397
- Singapore
 - Agency of Science, Technology and Research (ASTAR), 111, 114
 - public research institute, patent filings by, 114
 - recruitment policies of KTOs, 413
 - university, patent filings by, 114
- Slovakia, university ownership of patents in, 397
- Slovenia, university ownership of patents in, 397
- Socially responsible research
 - commercialization, 32–33, 34
- Social rate of return of investment in public R&D, 5
- South Africa
 - Agricultural Research Council (ARC), 330–331, 347, 349, 352
 - apartheid in, 328–329
 - Armscor, 331
 - Bio-economy Strategy, 340
 - Biotechnology Regional Innovation Centres, 336
 - business sector
 - linkage with public R&D, 337, 345–347
 - scient, technology, and innovation policy, 336–337
 - Centres of Competence, 335, 342–344
 - Centres of Excellence, 335
 - collaborative research in, 349
 - consultancies in, 341
 - contracts in, 341
 - Council for Geosciences, 330–331
 - Council for Mineral Technology, 330–331
 - Council for Scientific and Industrial Research (CSIR), 330–331, 335, 343, 347, 349–350, 352, 410–411, 413
- Denel, 331, 349–350
- Department for Planning,
 - Monitoring and Evaluation (DPME), 352
- Department of Science and Technology (DST), 333, 335, 339–340, 350, 354
- Department of Trade and Industry (DTI), 333, 337, 340, 354
- education and training in, 335, 337, 340–341
- Elsenburg Agricultural Training Institute, 343–344
- Eskom, 331, 349–350
- Global Entrepreneurship Monitor, 335–336
- government funding of R&D in, 13, 330
- Higher Education National Funding Formula, 335
- Human Sciences Research Council (HSRC), 330–331, 350
- income level, patent filings by, 93, 101, 107
- Industrial Development Corporation, 333
- Industrial Policy Action Plan, 337
- innovation
 - financing of, 333
 - in oil and gas sector, 343
 - outputs, 345
 - in platinum, 343
 - policy, 333–334
 - in pulp and paper sector, 343
 - surveys, 344
 - in viticulture, 343–344
- “innovation chasm,” 339
- Innovation Fund, 333–334, 335–336, 355
- Intellectual Property Rights from Publicly Financed Research and Development Act, 9, 333–334, 389, 390, 391
- IP office, patent filings by, 131–132
- knowledge capabilities gap in, 368
- knowledge transfer in
 - barriers to, 353
 - case study, 378

- South Africa (cont.)
- consultancies and, 341
 - demand-side incentives
 - supporting, 410–411
 - failures of, 337–339, 364
 - impacts of, 352–353
 - informal channels of, 341
 - IP-mediated knowledge transfer, 341–342, 349–352
 - KTOs, 351–352
 - legislation patterned on Bayh-Dole Act in, 406–407
 - metrics of, 344–352
 - non-IP-mediated knowledge transfer, 347–349
 - overview, 22, 328–329, 353–355, 389–392
 - patent licensing, 375–376
 - policies and practices, 378
 - policies to address failures of, 339–341
 - by public research institutes, 349–352
 - by universities, 349–352
 - university knowledge transfer policy, 8, 9
 - legislation patterned on Bayh-Dole Act in, 396
 - Medical Research Council, 330–331
 - metrics of knowledge transfer in, 426, 432–433, 436
 - Ministry of Higher Education and Training, 330
 - Mintek, 347, 349–350
 - National Advisory Council on Innovation, the Technology Innovation Agency (TIA), 334
 - National Development Plan (NDP), 329, 334, 355, 389
 - National Foundry Technology Network, 337
 - National Intellectual Property Management Office (NIPMO), 334, 340–341, 350, 353, 389–390, 391
 - National R&D Strategy, 333–334, 340
 - National Research Foundation, 330, 331, 334, 335, 336, 338
 - NECSA, 331
 - New Growth Path, 334
 - Office of Auditor General, 347
 - Office of Technology Transfer Support Fund, 389–390
 - oil and gas sector, innovation in, 343
 - Patent Cooperation Treaty (PCT) and, 331–333, 349
 - patent licensing in, 375–376
 - patent metrics in, 86
 - platinum, innovation in, 343
 - Public Investment Corporation, 333
 - public R&D in
 - linkage with business sector, 337, 345–347
 - scient, technology, and innovation policy, 335–336
 - public research institutes
 - collaboration with industry, 405
 - expenditures on R&D, 331, 332–333, 348
 - historical background, 330
 - IP management policies, 354
 - knowledge transfer by, 349–352
 - overview, 330–331
 - Public Research IP Act, 340, 353–354, 355
 - pulp and paper sector, innovation in, 343
 - rationale for inclusion in study, 18–21
 - R&D/GDP ratio in, 25–26
 - R&D Tax Incentive, 333–334, 355
 - Researcher Rating Scheme, 335
 - research publications in, 347–349
 - sanctions against, 328–329
 - science and technology policy, 333–334
 - Sector Innovation Fund, 339–340
 - Sector Innovation Programme, 339–340, 355
 - South Africa Bureau of Standards Design Institute, 337
 - South Africa Bureau of Standards (SABS), 330–331

- South African Patent Office (SAPO), 330, 331
- South African Research Chairs Initiative, 335, 336
- Southern African Research and Innovation Managers Association (SARIMA), 340–341, 350
- specialization of innovation in, 27
- state-owned enterprises in, 331
- technikons, 330
- Technology and Human Resources for Industry Programme (THRIP), 340, 343–344, 374
- “technology colony,” 339
- Technology Innovation Agency, 336, 352, 355
- Telkom, 331
- Ten-Year Innovation Plan, 333–334, 337, 339
- Transnet, 331
- Transnet Design, Innovation and Research Centre, 337
- universities
- collaboration with industry, 398, 405–406
 - expenditures on R&D, 331, 332–333, 348
 - historical background, 330
 - IP management policies, 354
 - knowledge transfer by, 349–352
 - knowledge transfer policy, 8, 9
 - KTOs in, 353
 - patent filings by, 114
 - research in, 330
 - USPTO and, 331–333, 349–350
 - viticulture, innovation in, 343–344
 - White Paper on Science and Technology, 333, 334, 340, 355, 363
- South African Wine and Brandy Company, 343–344
- Southeast University of China, 128
- Southern African Development Community (SADC), 454–455
- South Korea. *See* Korea, Republic of Korea
- failures of knowledge transfer in, 364
 - income level, patent filings by, 106
 - metrics of knowledge transfer in, 426, 436
 - RedOTRI, 426
 - universities
 - ownership of patents, 397
 - patent filings by, 114
- Spin-offs. *See also specific country*
- as channel of knowledge transfer, 217–218, 243, 266, 309, 398–400
 - universities and, 158–164, 398
- Squeff, F.H.S., 265, 275–276
- Stand-Alone Company Model, 171
- Standardized indicators, 59–60
- Stanford University, 236, 395
- Startups
- knowledge transfer and, 243–244, 245–247, 373
 - public research institutes and startups and, 422
- Stellenbosch University, 343–344, 349, 352
- Sunbiotech (Korea), 246
- Surveys
- of academics, 429–430, 436–439, 461–462
 - of firms, 429–430, 439–441, 461–462
 - Higher Education-Business and Community Interaction (HE-BCI) survey, 430–431
 - of KTOs, 53–56, 73, 428–429, 461–462
 - of public research institutes, 461–462
 - WIPO Assessment Questionnaire for Stakeholders from Academic and Research Institutions, 464–474 (*See also* WIPO Assessment Questionnaire for Stakeholders from Academic and Research Institutions)
- Sweden
- inventor ownership in, 397
 - metrics of knowledge transfer in, 436
 - national and institutional policies and practices supporting knowledge transfer in, 40

- Sweden (cont.)
 professor's privilege, abolition of,
 7, 397
 universities
 patent filings by, 114
 patenting activities of, 155
 Switzerland, university ownership of
 patents in, 397
- Takara Shuzo, 249
 Tan, J., 320–321
 Tan, L., 319, 322
 Tang, P., 171–172
 Taxol, 395
 Technical University of Denmark, 442
 Technical University of Munich, 221
 Technology field, patent filings by,
 107–112. *See also specific field*
 Telecommunications, patent filings
 in, 111
 Telles, L.O., 270
 Tengeh, R.K., 342
 Thailand
 channels of knowledge transfer in, 38
 government funding of R&D in, 13
 university knowledge transfer policy
 in, 7, 8
 “Third mission” policies, 6–9
 Thursby, G., 48
 Thursby, M.C., 48
 Todo, Y., 320–321
 Tokyo University, 111–114
 Toole, A., 218–219
 Turkomian, A.L.V., 269–270
 Toyota Jidosha, 114–128
 TRL scale, 254
 Tsinghua University, 128, 313, 320, 322
 Tunisia, university knowledge transfer
 policy in, 8–9
 Turchi, L.M., 271, 292, 293
 Turkey, patent filings by income level
 in, 93
 “Two-way flow” of ideas, 418
- Uganda, channels of knowledge
 transfer in, 38
 United Kingdom
 British Technology Group (BTG),
 149, 403, 404
 Catalyst Fund, 153
 Catapult Centres, 153
 channels of knowledge transfer in, 52
 Charities Act 2006, 144
 Co-Investment Fund, 155–156
 collaborative research in, 149, 154
 commercialization of IP in
 comparison of universities and
 public sector research
 establishments (PSREs),
 166–168
 KTOs and, 163
 patent licensing, 393–394
 public sector research
 establishments (PSREs)
 and, 164
 universities and, 158–164
 Community Innovation Survey
 (CIS), 168–169
 consultancies in, 174
 contracts in, 154, 414
 demand pull in, 365
 Department for Business, Energy
 and Industrial Strategy
 (BEIS), 144
 Department for Business, Innovation
 and Skills, 164
 Department for Education
 (DfE), 144
 Department for Employment and
 Learning Northern Ireland
 (DELNI), 144
 Department for Trade and Industry
 (DTI), 150
 Department of Culture, Media and
 Sport, 146
 displacement effects in, 413–414
 education and training in, 174
 Education Reform Act (ERA)
 1988, 143
 Enterprise Capital Funds, 155–156
 Enterprise Investment Scheme (EIS),
 155–156
 government regulation of IP rights,
 154–155

- Higher Education-Business and Community Interaction (HE-BCI) survey, 430–431, 460–461
- Higher Education Funding Council for England (HEFCE), 144, 145, 153, 172
- Higher Education Funding Council for Wales (HEFCW), 144
- Higher Education Funding Council (HEFC), 143
- Higher Education Innovation Fund (HEIF), 152–153, 156
- Higher Education Reach-out to Business and the Community (HEROBAC) Fund, 152
- Higher Education Statistics Agency (HESA), 168, 169
- income level, patent filings by, 93, 99
- Industrial Strategy Challenge Fund, 156
- Industrial Strategy White Paper, 156
- Innovate UK, 153
- knowledge capabilities gap in, 368
- Knowledge Exploitation Programme, 152
- knowledge transfer in
- case study, 378–379
 - commercialization activities, 157–158
 - community-based activities, 157–158
 - demand-side incentives supporting, 155–156
 - historical background of policies and practices, 148–151
 - incentives regarding, 173–176
 - legislation patterned on Bayh-Dole Act in, 404
 - national versus institutional policies and practices, 375
 - organizational practices, 169–173
 - overview, 22, 141–142, 173–176
 - path dependency and, 174
 - people-based activities, 157–158
 - policies and practices, 378–379, 403–404
 - problem-solving activities, 157–158
 - promotion of, 173–174
 - public sector research establishments (PSREs) and, 154
 - supply-side incentives supporting, 152–155
 - symbiotic relationship with socioeconomic structure, 174
 - universities and, 152–154
- Knowledge Transfer Partnership (KTP) Scheme, 153
- Lambert Agreements, 154
- LINK Scheme, 149
- local enterprise partnerships (LEPs), 151
- Medical Research Council (MRC), 146
- metrics of knowledge transfer in, 425–426, 427, 428, 430–431, 432–433, 436, 437, 460–461
- National Centre for Universities and Business (NCUB), 157, 166–167
- National Enterprise Board, 149
- National Research Development Corporation (NRDC), 149
- Office of Science and Technology (OST), 150
- open funding competitions in, 155
- Patent Law 1977, 154
- patent licensing in, 393–394
- patent metrics in, 86
- Polytechnics and Colleges Funding Council (PCFC), 143
- professor's privilege in, 163
- public sector research establishments (PSREs)
- commercialization of IP in and, 164–168
 - funding of, 146–148
 - governance agreements, 148
 - knowledge transfer and, 154
 - overview, 146–147
 - spin-offs and, 164

- United Kingdom (cont.)
- Public Sector Research Exploitation Fund, 154
 - rationale for inclusion in study, 18–21
 - R&D/GDP ratio in, 25–26
 - R&D tax credits in, 155
 - regional development agencies (RDAs), 151
 - Regional Innovation Fund, 151
 - research publications in, 169
 - Royal Society, 153–154
 - Science and Technology Committee, 156
 - Science Enterprise Challenge (SEC) Fund, 152
 - Scottish Funding Council (SFC), 144
 - Seed Enterprise Investment Scheme (SEIS), 155–156
 - Small Business Research Initiative (SBRI), 155
 - Social Investment Tax Relief (SITR), 155–156
 - Teaching Company Scheme, 149, 153
 - Teaching Excellence Framework (TEF), 145
 - UK Innovation Investment Fund, 155–156
 - UK Research Partnership Investment Fund, 153
- universities
- commercialization of IP and, 158–164
 - diversification of knowledge transfer policy, 411–412
 - funding of, 144–146, 148
 - geographic distribution of, 143–144
 - historical background, 142–143
 - incentives regarding knowledge transfer, 173–176
 - industry demand for knowledge from, 168–169
 - knowledge transfer and, 152–154
 - KTOs in, 169–171, 172
 - organizational practices, 169–173
 - ownership of patents, 397
 - patent filings by, 114
 - patenting activities of, 155
 - public versus private, 144
 - spin-offs and, 158–164
 - University Challenge Seed Fund, 152
 - University Funding Council, 143
 - Wellcome Trust, 153–154
- United States of America
- Advanced Technology Program, 396
 - Bayh-Dole Act, 6–7, 39, 71, 80, 83, 229, 257, 340, 362–363, 380, 394–398, 413–415, 457, 460
 - Defense Department, 396
 - Defense Industrial and Technology Base Initiative, 396
 - Engineering Research Centers, 396
 - Federal Technology Transfer Act, 396
 - improved evidence for policy-making in, 71
 - income level, patent filings by, 93, 97, 104
 - industry financing of R&D in, 48
 - IP licensing model in, 39, 394
 - IP office, patent filings by, 131–132
 - knowledge transfer in, 394–397
 - Manufacturing Extension Program, 396
 - metrics of knowledge transfer in, 426–427, 436, 444
 - mode 1 conception of knowledge transfer in, 363
 - national and institutional policies and practices supporting knowledge transfer in, 40
 - National Institutes of Health (NIH), 395
 - Silicon Valley, 396–397
 - Small Business Innovation Development Act, 396
 - Small Business Research and Development Enhancement Act, 396
 - standardized indicators in, 59
 - Stevenson-Wylder Technology Innovation Act, 396
 - surveys of KTOs in, 53, 56

- United States Patent and Trademark Office (USPTO), 81–82, 128–131, 331–333, 349–350
- universities
 - commercialization of IP and, 394–395
 - knowledge transfer policy, 6–7
 - patenting activities of, 155, 394–395
- Universidade de São Paulo, 269, 277, 282–284
- Universidade Estadual de Campinas, 269, 282–284, 290, 291
- Universidade Federal de Minas Gerais, 282–284, 291
- Universidade Federal de São Carlos, 269
- Universidade Federal do Paraná, 282–284
- Universidade Federal do Rio de Janeiro, 282–284
- Universities. *See also specific country; specific university*
 - commercialization of IP and, 398
 - convergence of knowledge transfer policies and practices in, 397–398
 - diversification of knowledge transfer policy, 411–412
 - financial incentives for, 412
 - foreign-oriented patent filings by, 90–92
 - incentives for participation in knowledge transfer, 31–32, 34
 - income level, patent filings by, 92–93
 - IP licensing model, effect of, 42–43
 - knowledge capabilities gap and, 366–369, 380
 - knowledge transfer policies and practices, 22
 - KTOs in, 35
 - lack of research capacity in middle-income countries, 412
 - leaves of absence in, 398
 - legislation regarding IP policies, 6–9, 80
 - metrics of knowledge transfer data from, 430–431
 - policies and practices supporting knowledge transfer, 431–436
 - middle-income countries, knowledge transfer policy in, 394
 - patent filings by university, 112–128 (*See also specific university*)
 - patent licensing and, 397–398
 - patent metrics (*See Patent metrics*)
 - patent ownership and, 397
 - professor's privilege, abolition of, 7, 41, 69, 163, 199–205, 397, 403
 - questions regarding knowledge transfer policies and practices, 414
 - role in public R&D, 12
 - spin-offs and, 158–164, 398
 - statistical trends in patent filings by, 90
 - successful knowledge transfer policies and practices, 369–371
 - technology field, patent filings by, 107–112
 - WIPO applicant names, verifying accuracy of, 137
- University of California, 111, 112
- University of Cape Town, 347, 349–350
- University of Heidelberg, 220–221
- University of Manchester, 149
- University of Pretoria, 343, 349
- University of Texas, 111, 112
- University of Witwatersrand, 343, 349–350
- Valorization, 205–206, 386–387
- “Vanity” metrics, 78
- Velez, M., 338
- ViroMed Inc., 249–250, 251
- Von Proff, S., 200
- Wang, B., 313
- Wang, Y.D., 311, 314
- WIPO Assessment Questionnaire for Stakeholders from Academic and Research Institutions, 464–474

- WIPO Assessment (cont.)
 financial incentives, 469
 funding of R&D, 471
 general information, 464–465
 IP and technology
 management, 467–469
 ownership of IP rights,
 465–466
 policy awareness, 472
 problems, challenges, and strategic
 issues, 473–474
 publication and dissemination
 policy, 472
 third-party engagement, 470
 Woltmann, S., 442
 World Intellectual Property
 Organization (WIPO)
 Assessment Questionnaire
 for Stakeholders from
 Academic and Research
 Institutions, 464–474 (*See also*
 WIPO Assessment
 Questionnaire for Stakeholders
 from Academic and Research
 Institutions)
 China in, 305
 Patent Cooperation Treaty (PCT)
 (*See* Patent Cooperation
 Treaty (PCT))
 public research institute applicant
 names, verifying accuracy
 of, 137
 university applicant names, verifying
 accuracy of, 137
 World University Rankings, 330
 Wuhan University, 322
 Wunsch-Vincent, Sacha, 282
 Yale University, 33
 Yoon, C.-M., 230
 Zhang, C., 339
 Zhang, M.X., 323
 Zhao, W.X., 320
 Zhejiang University, 128, 309, 322
 Zou, Y.H., 320