

Index

Abbasi, A., 72 expenditure information sources, Abernathy, W.J., 167 academic ability MMRD programs, 157, 186 talent-attracting programs, 137-141 Young Thousand Talents Program Bai Chunli, 116 (YTTP), 134–135, 143–145, 147, basic research agency expenditure, 111, 112, 150, 152–156 116-117, 120-123, 126, 127 achievement conversion, 40-41 agencies. See also economic agencies budget management, 101, 120 (Group 2); mission-oriented conclusions, 197, 201, 202, agencies (Group 3); S&T agencies 204, 208 (Group 1); supporting agencies enterprises, 125 (Group 4); specific agencies expenditure information sources, conclusions, 197-198, 205, 97, 98 MMRD programs, 157, 158, 160, 210, 211 functional categories, 77-78 186, 190 Bazhal, I., 12 inter-agency coordination, 46–53, 57-62, 75-76, 196-197 betweenness centrality, 72, 79, 88, introduction, 4, 15, 18-22 89,93 MMRD programs, 169-171, brain drain/gain 185-189, 192, 200 conclusions, 195, 198-199 R&D expenditure, 109-112, 122, decision matrix, 134, 139-141 124, 126–130 introduction, 131, 137 summary and discussions, 155, 156 R&D expenditure information Thousand Talents Program sources, 97-99, 127 revenue, 112, 115, 117-119 (TTP), 135 AHT Program, 190 Young Thousand Talents Program Airbus A300 Program, 178-179, 193 (YTTP), 141, 142, 146, 150, 153, 155 American Association for the Advancement of Science (AAAS), 1 Breznitz, D., 16 Anadón, L.D., 167, 169 Bush, Vannevar, 159 Apollo Program, 159, 162, 169, 173, 176-178 C9 League universities, 145, 146 Appelbaum, R.P., 17 Cao, C., 133, 141 applied research capitalism, types of, 13 Central Financial and Economic agency expenditure, 116-119, 123-127 Committee of the CPC, 21, 61, 69 budget management, 101, 111, 120 Chakravarthy, B.S., 167 conclusions, 197, 201, 202, 204 CHB Program, 189-190 enterprises, 125, 126 Chiang, J.T., 167, 170

236



Index 237

China Academy of Telecommunication defense Technology (CATT), 185 agencies, 197 MMRD programs, 160, 170, 176 China Association for Science and Technology (CAST), 1, 22, 84 private sector, 43 China Aviation Industry Corporation R&D expenditure, 109 (CAIC), 183 universities, 118, 119 China Railway Corporation degree centrality, 79, 86, 88, 89, 93 (CRC), 184 Deng Xiaoping, 36 Department Annual Reports on China Securities Regulatory Commission (CSRC), 51, 53 Financial Budgets and Final Chinese Academy of Engineering Accounts (DARs), 98, 99, 108, 118, 119, 125, 127 (CAE), 21, 89 Chinese Academy of Science (CAS) developmental state economic model budget management, 104 conclusions, 195, 200 conclusions, 197-198 interventionism, 13 policy network evolution, 85, 89 Japan, 11, 180 policymaking, 21 MMRD programs, 162, 163, 169, R&D expenditure, 110–112, 172, 180 Distinguished Young Scientist award, 115-117, 122, 123 R&D expenditure information 141 Dolla, V.S., 16 sources, 125, 128 talent-attracting programs, 145, 146 Drug Innovation and Development Civil Aviation Administration of China program (MEP-DID), 187-189 (CAAC), 182, 183 Commercial Aircraft Corporation of economic agencies (Group 2), 77, 78, China (Comac), 183 84, 89-93 economy. See developmental state Commission of Science, Technology and Industry for National Defense economic model; entrepreneurial (COSTIND), 20, 118 state; market-oriented economy; Communist Party of China's Central political economy; private sector Committee (CPC CC) education, 2, 10, 14, 43, see also Department of Organization (CPC academic ability; universities CC DOO), 84 enterprise-centered innovation system documents (Grade A policy), 30, 32, conclusions, 213 37, 40, 46, 59, 195-196 R&D expenditure, 6, 126–127, Medium and Long-Term 201 state involvement, 4, 18, 74, Plan...2006-2020 (MLP), 42, 60 policymaking, 21-22, 62, 92 202-203 R&D expenditure, 116 entrepreneurial state, 15, 159, 162, talent-attracting programs, 135, 198 169, 208 core-periphery networks, 71, 88-89, entrepreneurship, 17, 68, 135, 136 93, 137, 197 Ergas, H., 167, 168 COVID-19 pandemic, 207 Europe, 13, 172, 178-179 Cox's proportional hazards regression European Union, 172, 212 model, 143, 150, 152–156 experimental development expenditure, 97, 125, 201, 202 Dai, S., 17 exports Datang Telecom, 184-185 credit insurance, 57 decision matrix, brain gain, 134, products, 52, 72, 85, 209 139-141 subsidies, 11



238 Index

homogeneity dependence, 73 Fifth Generation Computer (FGC) Program, 180-181 Huang, Y., 18 financial crisis. See global financial crisis Huawei Technologies, 2, 206 financial policy definition, 27, 29 imports evolution of, 36, 37, 39, 40, 44, 45 products, 43, 44 institutional structures, 46, 51, technology, 39, 41, 43, 45, 118, 180, 212 indigenous innovation. See also summary and discussions, 59 National Innovation System (NIS) fiscal policy definition, 27-29 conclusions, 205-207, 211, 212 evolution of, 36, 37, 39, 40, 44, 45 innovation policy, 32, 36, 42-45, institutional structures, 46, 51–53, 57 57, 61 summary and discussions, 59 Medium and Long-Term Plan...2006-2020 (MLP), 32, 36, Foray, D., 159, 170 foreign investment, 14, 16, 42, 43, 42-44, 205, 211 85, 98 MMRD programs, 183, 185 Fuchs, E.R., 168 policy network evolution, 68, 72, Fuller, D.B., 16 83, 85 funding. See R&D expenditure previous research, 11, 14, 16 individual benefits General Administration of Customs talent-attracting programs, 131, (GAC), 41, 53, 82, 84, 89 134, 138-141 Glick, H.R., 67 Young Thousand Talents Program global financial crisis, 36, 44-46, 85, (YTTP), 154, 155 135, 208 industrial policy Global Innovation Index (GBI), 3 conclusions, 208 globalization, 13, 131, 206, 207 definition, 27-29 evolution of, 36, 37, 39-41, 43-45 governance conclusions, 207-213 institutional structures, 46, 48, policy networks, 64, 74, 169 51-53, 57 government. See state summary and discussions, 59 Government Finance Statistics (GFS), innovation 129 concept introduced to China, 39 gross expenditure R&D (GERD) definition, 8-9 innovation policy funding sources, 108, 125-129 conclusions, 195-197 information sources, 98, 104, 108, 110 evolution from 1980-1984, 32, 36-37 introduction, 1-2 evolution from 1985–1994, 32, 37–39 research types, 122, 124 evolution from 1995-2006, 32, 39-42 tensions, 201-203 evolution from 2006-2009, 32, 42-44 Hays, S.P., 67 evolution from 2009-2019, 44-46 He Jiankui, 209 institutional structures 1980–2005, 46-52, 57-59 Helpman, E., 10 heterogeneity dependence, 72-74, 79, institutional structures 2006-2019, 89-93, 197 52-59 research methodology, 29-32 high-end generic chips (HGCs), 189-190 high-speed rail (HSR), 184, 193 sub-domains, 27-29, 31, 45-46, 68 Hitch, C.J., 164 summary and discussions, 59-62



Index 239

innovation systems. See enterprise-MMRD end users, 170, 179, 181, centered innovation system; 184, 200 National Innovation System role in innovation, 8, 9, 17, 208 - 210(NIS); state-led innovation system institutions, 13, 14-15, 22, see also market-oriented economy, 10, 13, 173, agencies 203, 208, 213 intellectual property rights (IPRs), 42, Marx, Karl, 8 43, 45, 57, 206, 212–213 Mazzucato, M., 167, 168 McKean, R.N., 164 inter-agency policy coordination, 46-53, 57-62, 75-76, 196-197, Medium and Long-Term Plan for see also policy network the Development of Science and international standards, 42, 52, Technology (2006–2020) (MLP) 184-185 global financial crisis, 44 investigator-initiated research indigenous innovation, 32, 36, 42-44, 205, 211 programs, 160, 168, 177, 203-205 innovation policy, 32-36, 52-53, 57, 61, 74 investment foreign, 14, 16, 42, 43, 85, 98 inter-agency coordination, 57, private, 45, 168 60, 69 venture capital, 42, 44 MMRD programs, 172, 185 National Innovation System Jacobs, A., 172 (NIS), 202 Japan R&D expenditure, 101, 103, applied research, 124 112, 201 economic structures, 11, 13, 180 mega-engineering programs (MEPs) employment of Chinese nationals, budget management, 101, 104 Chinese Academy of Science MMRD programs, 179-182, (CAS), 117 189-190, 200 conclusions, 197, 198, 200, 204 Jia, Nan, 125 Ministry of Industry and Information Technology (MOIIT), Kaplan-Meier analysis, 143, 147-150, 110, 118, 127 Ministry of Science and Technology Kellogg, R.P., 138 (MOST), 110, 112, 115, 127, 128 Keynes, John Maynard, 9, 158 MMRD programs, 185–191, 200 R&D expenditure, 111, 120, 130 Knowledge Innovation Program (KIP), 40, 116, 117 mega-science programs (MSPs), 101, 103, 115, 123 knowledge production, 2, 10, 23 MEP-DID (Drug Innovation and Development program), 187-189 laissez-faire economies, 10, 13, 173 laws (Grade B policy), 30, 38-42, 46, migration. See talent-attracting 59, 196 programs Li, M., 133 ministerial regulations (Grade D List, Friedrich, 8, 10, 13 policy), 32-36, 42, 46, 48, 51, Lu Yongxiang, 116 79, 196 ministerial regulations/statutes (Grade D/C policy), 37-41, 59 Maastricht Memorandum, 159 Manhattan Project, 159, 162, 163, Ministry of Agriculture and Rural 169, 173–178 Affairs (MOARA), 20, 41, 78, market 101, 104, 125



240 Index

National Natural Science Ministry of Commerce (MOFCOM) innovation policy, 41, 48, 51, 53, 59 Foundation (NSFC) merger, 19, policy network evolution, 85, 86, 122, 127-128 overview, 19-20 88, 89 Ministry of Education (MOE) policy network evolution, 77, 84, innovation policy, 20, 51 86,88 policy network evolution, 85, R&D expenditure, 110-115, 128 88, 89 S&T policy, 41, 52, 53, 57, 59 R&D expenditure, 101, 104, 115, mission-oriented agencies (Group 3) 122, 123, 128 conclusions, 198, 205 talent-attracting programs, 53, 136, policy network evolution, 78, 84, 89,91 Ministry of Finance (MOF) R&D expenditure, 104, 110, 112, expenditure information sources, 122, 125, 127-128 98, 108, 110 mission-oriented mega-R&D programs fiscal policy, 51, 53 (MMRDs) industrial policy, 51 American cases, 159, 169, 172–178, innovation policy, 20, 41, 51, 60 191, 200 MMRD programs, 183 case study methodology, 161–163 conclusions, 199-200, 203-205 policy network evolution, 83, 86, 88, 89 cost-benefit consideration, 159-160, R&D expenditure, 99, 101, 103, 172, 178, 193 104, 108, 120, 197-198 European cases, 172, 178–179 S&T policy, 48, 57 framework development for the Ministry of Human Resources and adoption of, 161, 164-173 framework evaluation against Social Security (MOHRSS), 19, 41, 53, 78, 88, 104 Chinese cases, 182–191 Ministry of Industry and Information introduction, 157-161 Japanese cases, 179–182, 189–190, 200 Technology (MOIIT) summary and discussions, 191-193 innovation policy, 20 MMRD programs, 186, 189 Mowery, D.C., 160, 167, 169, 170 policy network evolution, 57, 78 Murphree, M., 16 R&D expenditure, 104, 109–112, 117-119, 127, 197 National Bureau of Statistics (NBS), Ministry of International Trade and 98, 109, 125 National Cancer Institute (NCI), Industry (MITI), Japan, 180, 181, 189 176 - 177Ministry of Railways (MOR), 184 National Committee of Chinese Ministry of Science and Technology People's Political Consultative (MOST) Conference (CPPCC), 19 budget management, 99, 103, 104, National Development and Reform 129 Commission (NDRC) conclusions, 197-198, 202, innovation policy, 44, 48, 51, 53, 57 205, 210 inter-agency coordination, 52, 60 expenditure information sources, 98, national S&T programs (NSTPs), 101, 109, 123 19, 20, 37, 198 innovation policy, 28, 41, 44, 51, policy network evolution, 78, 84, 86, 88, 89 53 - 57inter-agency coordination, 52, 57, R&D expenditure, 101, 111, 112, 60, 62 119-120, 129



Index 241

organization of S&T and innovation, national economic growth, 9-10 National Innovation System (NIS) 23, 26, 199-200 conclusions, 198, 202-203, 213 introduction, 10-12, 14, 16, 23, 24 patents, 2, 17, 23, 209 mega-engineering programs path dependence, 14, 71, 72, 191 People's Bank of China (PBOC), 41, (MEPs), 187 policy network evolution, 68, 77, 84 51, 53, 83 R&D expenditure, 117, 126 Pioneer Initiative, 116, 117 National Institutes of Health (NIH), policy agenda 160, 176-177 definition, 66, 67 National Key R&D Programs, 103, policy network evolution, 67-70, 115, 123, 204 72, 77, 82-86, 92 National Leading Group for Science policy documents. See also laws (Grade and Technology (NLGST), 21, B policy); ministerial regulations (Grade D policy); statutes (Grade 69, 75 National Natural Science Foundation C policy) of China (NSFC) co-sponsorship of, 52, 53, 75-76 conclusions, 197-198, 204 CPC CC (Grade A policy), 30, 32, 37, 40, 46, 59, 195–196 mega-engineering programs (MEPs), 186 policy network evolution, 75-76, Ministry of Science and Technology 79-80, 92 (MOST) merger, 19, 122, policy network 127-128 definition, 63, 64 governance, 64, 74, 169 policy network evolution, 85, 89 R&D expenditure, 104, 111, 112, policy network evolution conclusions, 81, 196-197 122-123, 127, 128 talent-attracting programs, 136, 141 heterogeneity dependence, 72-74, National People's Congress (NPC) 79, 89-93, 197 budget management, 103 hypotheses testing, 77–79 policy agenda, 67-70, 72, 77, introduction, 19, 21 laws (Grade B policy), 30, 38-42, 82-86, 92 policy documents, 75-76, 79-80, 92 46, 59, 196 power concentration, 70-72, 78, 86, 973 Program, 123 national S&T programs (NSTPs) 88-89, 92-93, 196 budget management, 100, 103, 104, summary and discussions, 92-93 theoretical background, 65-66 110, 112, 115 conclusions, 198, 203-205, 211 policymaking apparatus, overview, innovation policy evolution, 37–39, 17-22, 30 42, 45-46 policymaking, funding, talentintroduction, 19, 20 attracting and organization (PFTO) (four functions approach), mega-engineering programs 22-25, 195-200 (MEPs), 189 R&D expenditure, 117, 119, 123, political economy 128, 130 approach defined, 4, 8-9, 18, 24 "black box" metaphor, 14, 18, 97, neoclassical economics, 9, 10 new institutionalism school, 65, 66, 127, 197 77,86 conclusions, 194-195 literature overview, 10, 12-17 Office of Science and Technology state structural relations, 15, 18, 23, 25 Policy (OSTP), 62 tensions, 200-207



242 Index

S&T agencies (Group 1), 77, 78, 84, popularity effect, 66, 70, 71, 86, 93 power concentration, 70-72, 78, 86, 89, 91, 93 88-89, 92-93, 196 S&T expenditure agencies, 99, 109-112, 127 power-dependence school, 66, 72, 77, 91, 93 appropriation at key agencies, 112, preferential attachment, 66, 70-72, 116-120, 128 88-89, 93 budget management, 99-109, 129 private sector conclusions, 197-198 defense, 109 defense, 43 entrepreneurial state, 208 information sources, 100, 101, 104, investment, 45, 168 108, 109, 127 research types, 101, 111, 120, 126 mega-engineering programs (MEPs), 120 USA, 129-130 MMRD programs, 170, 173, 200 S&T policy definition, 27-29 public-private partnerships, 162, 169, 178, 195, 200, 203 evolution of, 36, 37, 39, 40, S&T enterprises, 41–43, 125, 169, 42-46 189, 202 institutional structures, 51-53, 57 Project Apollo, 159, 162, 169, 173, summary and discussions, 57, 59 176-178 S&T programs. See national S&T programs (NSTPs) R&D expenditure. See also Gross Sampat, B.N., 160, 167 Expenditure R&D (GERD) Schumpeter, Joseph, 4, 8, 12 agencies, 109-112, 122, 124, science parks 126-130, 197-198 introduction, 19, 41 "black box" metaphor, 97, 127, 197 university high-tech parks, 43, 44 central government budget, 99-109, Zhongguancun, 3, 16, 38, 45 Shi, D., 156 conclusions, 197-198 Shi Yigong, 136, 142 defense, 109 small and medium-sized enterprises introduction, 97-99 (SMEs), 23, 43–45, 57, 119 literature overview, 13, 14, 23, 27 Smith, Adam, 8, 9 summary and discussions, 127-130 social network analysis (SNA), 65, 66, R&D programs. See also mission-77, 92, see also policy network oriented mega-R&D programs evolution Solow, R., 9, 10 (MMRDs); national S&T programs (NSTPs) Spearman correlation, 86 exploitative, 167-168, 176, 181 standards, international, 42, 52, exploratory, 166–168, 173, 176, 177, 181, 190, 208 184-185 Star Wars Program (Strategic Defense research and development (R&D) Initiative [SDI]), 162, 173, economic growth, 10 176-178 institutional reforms, 40, 41, 43, 52 State. See also agencies networks, 168-170 innovation role, 12, 14, 15, 17, 22 literature overview, 12, 15–17 talents, 2, 14, 19, 23 revenue, agencies, 112, 115, 117-119 structural relations, 15, 18, 23, 25 "revitalizing the nation with science, State Administration of Foreign Experts Affairs (SAFEA), 19 technology and education (kejiao xingguo)" strategy, 1, 32, 68, 83, State Administration of Industry and 116, 194 Commerce (SAIC), 41, 51, 202



Index 243

State Administration of Science, MMRD programs, 169, 171, 179, Technology, and Industry for 181, 183–185, 189–190, 193 R&D expenditure, 109, 126-129 National Defense (SASTIND), statutes (Grade C policy), 30, 196 118, 119 State Administration of Taxation statutes/ministerial regulations (Grade (SAT), 41, 51, 53, 57, 88, 89 C/D policy), 37-41, 59 State Basic Research and Development Strategic Defense Initiative (SDI) Program (973 Program), 42, 103, (Star Wars Program), 162, 173, 176-178 115, 123 supporting agencies (Group 4), 78, 84, State Council agencies, 19, 104, 122 89,91 survival analysis, 135, 143-144, innovation policy process, 21 ministerial regulations (Grade D 148-150 policy), 32-36, 42, 46, 48, 51, Suttmeier, R.P., 141 79, 196 policy network evolution, 60, 61, talent-attracting programs. See also 69, 79, 85 Thousand Talents Program (TTP); R&D expenditure role, 97, 99, 103, Young Thousand Talents Program 104, 130 (YTTP) statutes (Grade C policy), 30, 196 conclusions, 198-199 decision matrix, 134, 139-141 statutes/ministerial regulations (Grade C/D policy), 37-41, 59 innovation policy, 23, 43, 44, 53 State Development and Planning introduction, 26, 131-135 Commission (SDPC), 20, 41 summary and discussions, State Economic and Trading 154-156 theoretical background and Commission (SETC), 20, 40, 41, 46 hypotheses, 137–141 talents, 2, 14, 19, 23 State Economic Commission (SEC), 37, 39, 41, 46 Taube, M., 17 State High-Tech R&D Program (863 tax policy Program), 38, 42, 103, 115, 124 definition, 27-29 State Key Laboratory (SKL) evolution of, 36, 37, 39-45 institutional structures, 46, 51, Program, 115 State Planning Commission (SPC), 20, 53, 57 37, 46, 82, 83 summary and discussions, 59 State Science and Technology Taylor, M.Z., 13, 14 Commission (SSTC), 19, 37-41, TD-SCDMA standard, 184-185 82,99 techno-industrial policy, 205 state-led innovation system technology development, expenditure conclusions, 190, 194-195, on, 112, 186, 204 202-203, 207, 210 technology-organization-market (TOM) framework four functions approach, 22, 23 policy evolution, 29 conclusions, 199-200 power/impact, 18, 22 development, 161, 164-173 State-owned Assets Supervision and evaluation, 182–191 summary and discussions, Administration Commission (SASAC), 115, 127, 203 191-193 state-owned enterprises (SOEs) techno-nationalism, 206 conclusions, 195, 203 telecommunications standards, innovation policy, 23, 45 184-185



244 Index

Third Ministry of Machine Building (TMOMB), 182, 183
Thousand Talents Program (TTP), 133, 135–136, 142–143, 156, 198–199, see also Young Thousand Talents Program (YTTP)
Tian, F., 134, 144
Tugan-Batanobvsky, Mikhail, 12

United Kingdom, 13, 131, 144, 201 United States of America (USA) comparisons with China, 1, 2 gross expenditure R&D (GERD), 1, 124, 201 innovation policy, 13, 30, 212 laissez-faire economy, 13, 173 MMRD programs, 159, 169, 172-178, 191, 200 Office of Management and Budget (OMB), 129-130, 198 returnees educated in, 146, 154 talents attracted to, 131, 136, 138, 139, 142, 144, 155 Thousand Talents Program, impact of, 136, 199 trade dispute with China, 206, 209 universities. See also academic ability C9 League, 145, 146 defense-related, 118, 119 research-oriented, 23, 43

Van Noorden, R., 154 Vandermoere, F., 171 venture capital, 42, 44 Vernadsky, Vladimir, 12 Verschraegen, G., 171

science parks, 43, 44

Very Large Scale Integration (VLSI) Program, 180–181, 189–190 Very-High-Speed Integrated Circuits (VHSIC) project, 176 Vink, M., 172

Wade, R., 13
Wang, H., 134, 156
Wang Xiaodong, 136
Wang Zhigang, 133
War on Cancer, 162, 171, 176–178, 190
White G., 13
"whole-of-the-nation system" (juguo tizhi), 23, 199–200, 207

Xi Jinping, 116 Xie Xiaoliang, 136

Young Thousand Talents Program (YTTP)
age and gender, 144–146, 150, 153, 155
case study, 135, 136, 141–147
conclusions, 198–199
Cox's model, 143, 150, 152–156
Kaplan-Meier analysis, 143, 147–150, 155
previous research, 133, 134
summary and discussions, 154–156
Yun-10 (Y-10/708) Program, 182–183, 192, 193

Zeithammer, R., 138 Zheng, H., 74 Zheng, Y., 18 Zhongguancun Science Park (Beijing), 3, 16, 38, 45 Zhou, Y., 16 Zweig, D., 134, 156