

## Index

---

- 3D printing, 23, 45  
 81 Unit, 186  
 8200 Unit, 186  
 863 Program, 47, 103, 107, 122
- Adamsky, Dima, 175  
 Advanced Light Helicopter (ALH), 131  
 Advanced Technology Centres (ATC), 163, 165  
 Advanced Technology Program (ATP), 70  
 aeronautics, 53, 57, 59, 141  
 Aeronautics Ltd., 175  
 Aerospace Corporation, 76  
 Afghanistan, 78  
 Airbus, 41, 45, 102  
 aircraft, 38, 133, *see also individual aircraft*  
   and advanced technology, 18  
   and arms imports, 136  
   and civilian firms, 7, 26, 49, 54, 188  
   and conversion, 41–2, 59, 63–5, 73–4, 102, 191  
   combat, 51  
   conversion, 103  
   and dual-use technology, 45, 108–9  
   and J/V, 102–3  
   industry, 53  
   rising cost of, 35  
 aircraft carrier, 29, 51, 54, 59, 124, 134  
 Airmap, 81  
 AirSea Battle (ASB), 79, 219  
 Akash missile, 132  
 Alibaba, 1, 12  
 Alic, John, 65  
 Alouette III helicopter, 131  
 Amazon, 1, 82  
 American Civil War  
   and arms manufacturing, 26–7, 29, 51–2  
 American system of manufacturing, 52  
 AMRAAM, 18  
 anti-access/area denial (A2/AD), 79, 219  
 antiship cruise missile (ASCM), 172, 174  
 Apollo rocket, 66
- Apple, 65, 193  
 application-specific integrated circuits (ASIC), 67  
 Arazi, Efi, 191  
 ARJ-21, 108  
 Arjun tank, 131, 136  
 Arleigh Burke-class destroyer, 58  
 arms acquisition, 129, 149–55  
   and China, 94  
   and civilian firms, 168  
   and India, 146–55, 168  
   and military threat, 156, 166  
   and state-centric configuration, 217  
 arms development  
   and China, 96, 112  
   and India, 131, 143, 168–9  
   and Israel, 174  
   and MCF, 116, 127  
   and private sector, 144, 146, 180  
 arms exports  
   and India, 143, 168, 215  
   and Israel, 171, 176  
   and United States, 58  
 arms imports, 129, 218  
   and China, 92–3  
   and India, 143, 211  
   and United States, 58  
 arms production, 26, 204, 221  
   and China, 90, 100, 104  
   and civilian sector, 7, 115–16, 187  
   and India, 134, 137, 143  
   and Israel, 171–2, 176  
 arms race, 11, 32  
 ARPANET, 74  
*Art of War* (Sun Zi), 98  
 artificial intelligence (AI)  
   and 4IR, 1–2, 18, 22  
   and China, 12, 128  
   and China's military modernization, 111  
   and civilian sector, 7, 208  
   and globalization, 222  
   and India, 168

- and India's military modernization, 158–60, 167
- and Israel, 183–5, 193–5
- and MCF, 46–7, 85, 88, 113, 125
- and Russia, 5–6, 9
- strategic implications of, 204, 209–12, 220–1
- and United States, 80–4
- Ashok Leyland, 132
- Atomic Energy Commission, 60
- anuda akademii* (academic reserve), 190
- Australia, 32, 144, 179
- autonomous systems, 1, 18
  - and Indian army, 159
  - and US military, 80–1, 84
  - and US–China military competition, 222
- dual-use technologies, 46
- autonomous vehicles, 12
  - and China military, 113
  - and Israel military, 5, 183
  - and Israel's MCF, 193
- AV-8B Harrier, 35
  
- B-10 bomber, 53
- B-17 bomber, 64
- B-2 bomber, 57
- B-21 bomber, 57
- B-29 bomber, 64
- B-47 bomber, 64
- B-52 bomber, 64
- Barak missile, 137
- Bath Iron Works, 28, 57
- battlefield management system (BMS), 164
- Bedi, Rahul, 139
- Beidou navigation satellite system, 108
- Belarus, 144
- Béraud-Sudreau, Lucie, 111
- Bharat Dynamics Ltd. (BDL), 133
- Bharat Earth Movers Ltd. (BEML), 133, 153
- Bharat Electronics Ltd. (BEL), 131, 133, 162
- Bharat Forge, 132, 154, 165
- Biden, Joseph, 83
- big data, 1–2, 18
  - and Chinese military, 113
  - dual-use technologies, 46
  - and Indian armed forces, 158
  - and Israel's MCF, 193
  - and MCF, 36
  - and US military, 80, 86
- biotechnology, 47, 84, 106, 190
- block-chains, 22, 81
  - and MCF, 36
- Boeing, 64
  - and CMI, 66, 73–4
  - and defense industry conversion, 39
  - J/V in China, 102
  - and MCF, 64, 216
- Boeing 377 Stratocruiser, 64
- Boeing 707, 41, 64
- Boeing 747, 64
- Boeing Vertol, 69
- Bombardier, 102
- Brazil, 28, 32, 222
- Britain, 2, 32, 136
- Brzoska, Michael, 44, 71
- Bush, George H. W., 70
- Bush, George W., 73, 76–7
- Buy and Make, 146–7, 149
  
- C-130J aircraft, 137
- C-135 aircraft, 64
- C-137 aircraft, 64
- C-17 aircraft, 41, 73, 137
- C-919 aircraft, 108
- C-939 aircraft, 108
- C-97 Stratofreighter, 64
- Carl Gustaf rifle, 131
- cellular communication, 36
- Central Commission for Integrated Military and Civilian Development, 37, 47, 89, 111
- Central Military Commission (CMC), 96
  - Equipment Development Department (EDD), 96
- CH-46 helicopter, 69
- CH-47 helicopter, 69
- Check Point Software Technologies, 192
- Cheung, Tai Ming, 17, 110
- Chin, Warren, 27, 31, 50
- China
  - and 4IR, 2
  - high-tech industry and CMI, 103–5, 110
  - military doctrine and CMI, 98–100
  - military doctrine and technology, 90
  - military expenditures, 91–3
  - S&T CMI, 122
  - S&T weakness, 109
- China Electronics Technology Group Corporation (CETC), 97, 107
- Chinese Communist Party (CCP), 19, 108
- Chinese Academy of Sciences (CAS), 37
- Civilian Participation in Military Technology and Products Catalogue (*min canjun jishu yu chanpin tuijian mulu*), 117
- civil-military integration (CMI), 19–21, 25, 37–40, 47

## 252 Index

- civil–military integration (CMI) (cont.)  
 and China, 88–9, 107–12, 126–7  
 and China defense industry reform, 94, 104  
 and conversion, 76  
 and India, 129–45, 151–3, 166, 168  
 and Israel, 186–7, 190, 200  
 and People’s War doctrine, 98–9  
 in post-Mao China, 101  
 and United States, 69–78, 84  
 Clemens, Morgan, 110  
 Clinton, Bill, 70, 73, 76  
 cloud computing, 81, 158  
 Cochin Shipyard, 134  
 Cold War  
 and CMI, 7, 63–7  
 arms manufacturing before, 208  
 arms sales after, 174  
 civilian technology after, 4  
 military development after, 32–3  
 and military R&D, 38–9, 52, 60–1  
 technological development during, 1, 35–6, 49–50  
 combat information center, 72  
 command and control  
 4IR’s military implications, 23  
 and China’s MCF, 47, 124  
 and China’s military strategy, 219  
 and Israel’s MCF, 160, 184, 206  
 and MCF, 113  
 command, control, communications,  
 computing, intelligence, surveillance,  
 and reconnaissance (C4ISR)  
 and IDF’s quest for 4IR technologies,  
 183–4  
 and Israel’s defense industry, 175, 212  
 and Israel’s MCF, 160  
 and military transformation since the  
 1990s, 18  
 and US’ military transformation, 77  
 and US–China rivalry, 79, 219  
 commercial off-the-shelf (COTS), 196–7,  
 216  
 and China’s military, 42–3  
 and CMI, 19, 37, 75  
 and India’s military, 159–60  
 and Israel’s military, 197, 213  
 and MCF, 25, 82, 213  
 and military threats, 182  
 and military-technological innovation, 78  
 and spin-on, 41  
 Commission for Science, Technology, and  
 Industry for National Defense  
 (COSTIND), 94  
 competitive strategy, 8, 21, 218, 221–2  
 composite materials, 7, 113, 116, 190  
 computer numerically controlled (CNC),  
 105  
 computer-aided design/computer-aided  
 manufacturing (CAD/CAM), 30, 42,  
 54, 104–5  
 computer-integrated manufacturing  
 systems (CIMS), 105  
 Confederation of Indian Industry (CII),  
 146  
 Convair, 66  
 Cooperative Research and Development  
 Agreements (CRADA), 45, 70  
 Counter-rocket, artillery, and mortar  
 (C-RAM), 175  
 CR-929 aircraft, 108  
 Crimean War, 27  
 cyber, 79, 204, 206, 209  
 and 4IR military technologies, 5, 22–4,  
 221  
 and China’s military modernization, 114,  
 157  
 cybersecurity, 57, 197, 204  
 domain, 79, 86  
 and India’s military modernization,  
 158–61  
 and Israel, 175, 182–4, 194, 200, 205  
 and US military development, 80–1, 84,  
 219–20  
 warfare, 212  
 weapons, 79  
 Dassault, 28, 174  
 Defence Acquisition Procedure 2020 (DAP  
 2020), 151, 154, 160  
 Defence India Start-up Challenges (DISC),  
 162  
 Defence Investor Cell (DIC), 153  
 Defense Advanced Research Projects  
 Agency (DARPA), 57  
 ARPA, 71, 73  
 and 4IR, 83  
 and CMI, 71  
 development of the Internet, 74  
 and dual-use technologies, 45  
 and national S&T development, 57, 60,  
 63  
 and US semiconductor industry, 67  
 role in national innovation system, 37  
 defense contracts  
 barriers, 75  
 challenges, 43  
 and civilian firms, 7, 203  
 and CMI, 36, 61, 69, 75  
 and defense industry conversion, 66

- and India's CMI, 153, 164
- and iron-triangle, 30, 54
- and Israel's MCF, 203
- and MCF barriers, 213
- and spin-off technology in the US, 30
- and US defense industry, 57–8
- and US economy, 54
- and US high-tech industry, 31
- defense industrialization, 31
- defense industry, 216
  - of China, 90, 94–7
  - of India, 130–4, 137, 139, 141
  - of Israel, 171–6, 179, 212
  - challenges to, 32–5
  - conversion of, 102
  - development of, 7, 25–30, 188, 190
  - during the Cold War, 29–30
  - India protection of, 152
  - isolation of, 38, 214
  - monopoly of, 154–5, 213
  - and buyer–seller relationship, 95
  - and market forces, 67, 218
  - and monopoly in India, 152
  - and R&D hierarchy, 7
  - and technological development, 30–1
  - and the state, 32
  - and US protection of, 57–8
  - of the United States, 51–5, 67–8, 78
- Defense Innovation Initiative (DII), 80–1
- Defense Innovation Unit (DIU), 81, 86, 210
- Defense Procurement Procedures (DPP)
  - private industry's participation in military procurement, 146–52
- Defense Public Sector Undertakings (DPSU), 131, 153
  - advantage of, 152, 154
  - and CMI, 145–6
  - and competition, 134, 148–9, 151
  - and J/V, 141
  - and MCF, 162
  - and monopoly, 132–3
  - deficiency of, 137–9
- Defense Research and Development
  - Organization (DRDO), 132, 134, 138
  - and arms production inefficiency, 139–40
  - and CMI, 148–9, 151, 153
  - and defense indigenization, 131
  - and MCF, 161–6
  - and relationship with DPSUs, 134
- defense technology and industrial base (DTIB)
  - and dual-use technology, 36
  - and MCF, 37, 39–40
  - MCF success conditions, 8
  - and national S&T, 35
  - and spin-on technology, 40
  - United States' MCF, 46
- Deng Xiaoping, 101
- Department of Defense (DoD)
  - and 4IR technologies, 50
  - and China's MCF, 125
  - and CMI, 67, 70–1, 75
  - and CMI barriers, 76
  - and defense conversion, 72
  - and MCF, 78, 82–7, 210
  - and national R&D, 50, 60, 63
  - and RMA, 77
- Department of Homeland Security, 223
- Digital Ground Army (DGA), 184
- digital revolution, 21
- Directorate of Defense Research and Development (DDR&D, *MAFA'T*), 194, 198
  - MAFA'T* Challenge, 198
- Directorate of Industry Interface & Technology Management (DIITM), 153
- Dual-Use Science and Technology Program (DUS&T), 73
- dual-use technology, 44
- DuPont, 53
- Dynamic random-access memory (DRAM), 65, 67
- E-3 Sentry, 64
- E-8 JSTARS, 64, 79
- East China Sea, 79, 219
- Elbit Systems, 172, 175, 177–8
- electronic warfare, 31, 63, 133, 158, 164
- Electronics Resurgence Initiative, 83, 86
- Elfassy, Guy, 175
- Elron Electronic Industries, 172, 191
- Engelbrecht, H. C., 53
- F/A-18 Hornet fighter, 35, 57, 136
- F-15 Eagle fighter, 35, 57
- F-16 fighter, 35, 57, 136
- F-22 Raptor, 35
- F-35 combat aircraft, 35, 57
- Facebook, 193
- Fairchild, 31, 62
- federally funded research and development center (FFRDC), 57
- flat-panel display (FPD), 72
- Flat-Panel Display Initiative (FPDI), 45, 72
- Ford Aerospace, 31, 62
- Ford Motors, 45, 193
- Ford, Christopher Ashley, 125
- Fordham, Benjamin, 205

## 254 Index

- fourth industrial revolution (4IR), 1–2, 21–4  
 and dual-use technology, 46  
 and India's high-tech industry, 13  
 and MCF, 6–8, 21–2, 48, 208, 212–15  
 and states' competitive strategy, 208–9  
 China's quest for, 112–13  
 India's quest for, 159  
 Israel's quest for, 180, 183  
 military relevance of, 22–4  
 strategic implications of, 205–6, 220–2  
 and US–China rivalry, 209, 220
- France  
 and CMI, 45  
 arms embargo on Israel, 173  
 arms exports to India, 131, 136  
 defense industry of, 32  
 military expenditure, 33
- Franco–Prussian War, 27
- Gabriel missile, 172, 174  
 Galil, Uzia, 191  
 Galram, 191  
 Garden Reach Shipbuilders Engineers Ltd. (GRSE), 133  
 Gemini rocket, 66  
 General Armaments Department (GAD), 94, 96  
 General Dynamics, 30, 54, 66  
 General Motors (GM), 45, 84, 193  
 Germany, 33, 107, 109  
 Gilat Satellites, 192  
 Global Innovation Index, 11, 13  
 Global Positioning System (GPS), 38, 74, 79, 162  
 global value chain, 144  
 GM Defense, 84  
 Goa Shipyard Ltd. (GSL), 133  
 Google, 1, 7, 85, 193  
 Gore, Al, 70  
 Gouré, Dan, 58, 219  
 government laboratories, 37  
 government-owned and -operated (GOGO), 76  
 GPS-guided bombs, 18  
 Grumman, 39, 69, *see also Northrop Grumman*  
 Gulf War, 75
- Hagel, Chuck, 80  
 Halamish, Nir, 195  
 Hamas, 206  
 Hanighen, FC, 53  
 Hanwha Techwin, 153, 165  
 Harpy attack drone, 174
- Heinrich, Thomas, 30–1, 61  
 HF-24 Marut, 131  
 Hindustan Aeronautics Ltd. (HAL), 28, 131–2, 136, 162  
 Hindustan Shipyard Ltd. (HSL), 133  
 Hooda, Deependra Singh, 159, 167  
 Howitzer, 52, 137, 153, 165  
 HP, 193  
 HS-601, 73  
 Hu Jintao, 19, 110  
 Huawei, 12, 126, 193  
 Hughes Space and Communications, 73  
 Hummer, 73
- IBM, 193  
 IdeaForge, 165  
 IDF Strategy (*estrategiat Tzahal*), *see Israel military doctrine*  
 Imaging Ltd. (Medtronic), 191
- India  
 involvement of high-tech industry in military R&D, 162, 168  
 military doctrine and assimilation of advanced technological means, 167  
 military doctrine and MCF, 157  
 military expenditures, 134–5, 137  
 pursuit of MCF, 156, 211
- Indian army  
 acquisition from civilian firms, 153, 164  
 and Land Warfare Doctrine, 158  
 arms acquisition, 136
- Indian Institute of Technology (IIT), Bombay, 163  
 Indian Institute of Technology (IIT), Delhi, 163  
 indigenously designed, developed, and manufactured (IDDM), 150
- Indonesia, 28, 32  
 industrial demonstration zones (*jumin ronghe chanye jidi*), 118  
 information warfare, 24, 158–9  
 informationization, 88  
 information-technologies revolution in military affairs (IT-RMA), 77–8
- Ingalls Shipbuilding, 57  
 Innovation for Defence Excellence (iDEX), 162  
 INS Vikrant, 134  
 Integrated Guided Missile Development Program (IGMDP), 131
- Intel, 193  
 intellectual property (IP), 109–10, 119–21, 203  
 intellectual property rights (IPR), 43, 161  
 Internet, 21, 24, 81

- and MCF, 36
- and military R&D, 30, 74
- spin-off technology, 38
- internet of things (IoT), 7, 22, 81
- and China's pursuit of MCF, 113
- and IDF's quest for 4IR, 184
- and Israel's MCF, 193
- and United States' MCF, 84
- Iran, 17
- Iraq, 78, 205
- Iron Dome, 175
- IROV Technologies, 165
- Israel
  - air force (IAF), 186, 191, 212
  - high-tech industry and MCF, 202–3
  - high-tech industry: defense establishment connections, 190–3, 200–1
  - Industry Center for R&D, *see Israel Innovation Authority*
  - military doctrine and 4IR, 5, 170
  - military doctrine and technology, 182, 207
  - National Cyber Bureau, 194
  - Space Agency, 200
- Israel Aerospace Industries (IAI), 172, 175, 179, 190
- Israel Defense Forces (IDF)
  - and 4IR, 170, 207
  - and CMI, 187–9
  - focus on indigenous technology-intensive force multipliers, 174
  - preference for imported arms, 173
  - reliance on advanced technology solutions, 175, 183–4
  - and self-sufficiency, 173
- Israel Innovation Authority (MATIMOP), 192, 199
- Meimad, 200
- Israel military doctrine (IDF Strategy), 182, 186
- Israel Military Industries (IMI), 28, 172
- Israel Shipyards, 175
- Israeli High-Tech Association, 194
- Jaguar aircraft, 131
- Japan
  - arms production and the state, 32
  - export of semiconductors to China, 223
  - JVs in China, 107
  - private sector's R&D expenditure, 10
  - R&D expenditure, 109
  - semiconductor exports to United States, 67
  - technological relations with United States, 72
- Jayal, B. D., 141
- Joint Artificial Intelligence Center (JAIC), 82, 86, 210
- Joint Concept for Access and Maneuver in the Global Commons (JAM-GC), 79, 219
- Joint Enterprise Defense Infrastructure, 82
- Joint venture (JV)
  - and Israel's MCF, 200
  - India's military technology transfer and, 147–8
- Kamorta-class corvette, 134
- Kargil War
  - and India's defense procurement, 140, 146
- Katzir, Ephraim, 192
- Kaushik, Chandrika, 145
- KC-135 refueling plane, 64
- Kelkar Committee, 148
- Kfir fighter, 174
- Kirchberger, Sarah, 22
- Kolkata-class destroyer, 133
- Konkurs-M missile, 136
- Krepinevich, Andrew, 77
- Krivak III frigate, 134
- Krupp, 53
- Kudu Dynamics, 81
- Kumar, Vendana, 156
- L-1011 airliner, 66
- L3Harris, 81
- Lafferty, Brian, 110
- Langlois, Richard N., 63
- Larsen & Toubro (L&T), 132, 153, 164, 211
- Laskai, Lorand, 110, 215
- Lavi fighter, 174
- Lawrence Livermore, 57, 76
- Leander class frigate, 131
- Lebanon War (2006), 185
- Lebel, Udi, 187
- Lethal autonomous weapons systems (LAWS), 158
- Light Combat Aircraft (LCA), *see Tejas fighter*
- Lockheed, 28, 30, 54, 66
  - Skunk Works, 57, 217
- Lockheed Missiles and Space Company (LMSC), 31, 62
- Logic Hub, 82
- Long March space-launch vehicles, 102
- Long-Range Research and Development Program Plan (LRRDPP), 81
- Long-Term Integrated Perspective Plan (LTIPP), 145
- Los Alamos, 57, 76

## 256 Index

- Lotem (cyber defense directorate), 184  
 Luz guided missile, 173
- M1 tank, 58  
 M1A2, 58  
 machine-learning, 22, 46, 80–1, 125, 210  
 Made in China 2025 Program, 113, 210  
 MAFAT, *see* *Directorate of Defense Research and Development*  
 Mahindra, 132  
 Mahmood, Ishtiaq P., 9  
 Mahnken, Thomas G., 17, 218  
 maintenance, repair, and operations/  
 overhaul (MRO), 142, 145, 216  
 man–machine interface, 22–3  
 Manned Orbiting Laboratory (MOL),  
 66  
 Manos, Ronny, 175  
 Mao Zedong, 98–101  
 market economy, 7, 9, 94, 121, 215, 218  
 Martin Marietta Corp., 39  
 Mastiff, 174  
 MATIMOP, *see* *Israel Innovation Authority*  
 Maxim, 53  
 Mazagon Dock Ltd. (MDL), 133  
 McDonnell Douglas, 39, 42, 66, 102–3  
 Medium and Long-Term Defense Science  
 and Technology Development Plan  
 (MLDP), 42, 105  
 Medium and Long-Term Science and  
 Technology Development Plan  
 (MLP), 42, 105, 113, 210  
 Medium Multi-Role Combat Aircraft  
 (MMRCA), 136  
*Merchants of Death*, 53  
 Merkava tank, 173, 197  
 micro-, small- and medium-sized  
 enterprises (MSME)  
 and India's CMI, 132, 140–50  
 and India's MCF, 162–4  
 microprocessor  
 and 4IR, 83  
 and civilian industry's technological  
 leadership, 66  
 and spin-off technology, 65  
 and spin-on limitations, 67  
 Microsoft, 7, 82, 193  
 microwave  
 and CMI, 70  
 and spin-off technology, 30–1, 61  
 MiG-21, 131  
 MiG-27, 131  
 MiG-35, 136  
 Milan antitank guided missile, 131  
 Milan-2T missile, 136  
 military  
 4IR and effectiveness of, 2, 4  
 impact of technology on, 3  
 innovation and technology, 17, 170, 181–2  
 military contracting, *see* *defense contracts*  
 military contracts, *see* *defense contracts*  
 military–civil fusion (MCF)  
 success conditions of, 8, 213  
 mil-spec, 66–7, 75  
 miniaturization, 22, 46, 62, 67  
 Ministry of Electronic Industries (MEI), *see*  
*Ministry of Industry and Information  
 Technology (MIIT)*  
 Ministry of Industry and Information  
 Technology (MIIT), 107, 117, 119  
 Ministry of Machine Building (MMB), 90  
 Mirage-5 fighter, 174  
 missile defense, 18, 80, 175, 185  
 Mossad, 186  
 Motorola, 75  
 Mowery, David C., 63  
 multi-domain battle (MDB), 219  
 multinational corporations (MNC)  
 and civil–military technological  
 hierarchy, 7  
 and Israel's MCF, 193  
 Mulvenon, James, 42, 100
- Nag missile, 132, 136  
 Naik, Pradeep Vasant, 142  
 nanotechnology, 183, 212  
 Naravane, Manoj Mukund, 158  
 National Aeronautics and Space  
 Administration (NASA), 59–60, 66, 71  
 National Automotive Center, 45  
 National Defense Science and Technology  
 Commission (NDSTC), 101  
 national innovation system, 9  
 and defense industry's role in, 37  
 and in United States, 209  
 and private sector's role in, 9–10  
 National Institute of Standards and  
 Technology, 70–1  
 National Military–Civilian Integration  
 Public Service Platform (*guojia junmin  
 ronghe gonggong fuwu pingtai*), 117  
 National Plan on the Prospect of the  
 Development of Science and  
 Technology, 101  
 National Science Foundation (NSF), 37,  
 55, 60, 63, 71  
 National Security Commission on Artificial  
 Intelligence (NSCAI), 51, 85, 209–10  
 Navigation, 113–14  
 Netanyahu, Benjamin, 194  
 network-centric warfare (NCW), 77, 159

- New Generation Artificial Intelligence  
 Development Plan, 111, 211  
 New Generation Artificial Intelligence Plan,  
 211  
 Newport News Shipbuilding, 30, 54  
 Nie Rongzhen, 101  
 night-vision system, 72  
 North American Aviation, 30, 54  
 Northrop, *see Northrop Grumman*  
 Northrop Grumman, 30, 57  
 Nouwens, Meia, 111  
 nuclear energy, 30, 54, 101
- Oak Ridge, 57  
 Ofek 324 Unit, 186  
 Office of Technology Assessment (OTA),  
 19, 37, 46, 74–6  
 Office of the Under Secretary of Defense for  
 Industrial Policy, 78  
 Online military procurement system  
 (*quanjun wuqi zhuangbei caigou xinxi  
 wang*), 117, 120  
 Opto-electronics, 47, 103  
 Ordnance Factory (OF), 132, 136, 139, 154  
 original equipment manufacturer (OEM),  
 145, 149
- P-8 maritime patrol aircraft, 137  
 Paglin, Guy, 197  
 Pakistan, 5, 28, 135, 157  
 Panwar, Ravindra Singh, 158  
 peace dividend, 33, 39, 68, 70  
 Pentagon, 63, 83  
 People's Liberation Army (PLA)  
 as a client, 91, 96, 118–23, 127  
 civilian production, 100  
 and MCF, 88, 124  
 pursuit of advanced technology, 90  
 People's War, 90, 98  
 Persian Gulf, 79, 206  
 Phalcon system, 137  
 Philco., *see Ford Aerospace*  
 Phillips, 193  
 Pinaka rocket launcher, 153  
 Popeye missile, 174  
 Prakash, Arun, 141–2, 159  
 Pratt & Whitney, 41, 74  
 Project Maven, 82, 85–6  
 Putin, Vladimir, 5–6  
 Python missile, 174
- quantum computing, 82  
 4IR, 1, 22, 210  
 and civil–military technological  
 hierarchy, 7  
 and dual-use technology, 46  
 and India's military doctrine, 158  
 and Israel's pursuit of 4IR technologies,  
 194  
 and MCF, 36  
 and United States' MCF, 86  
 and US military transformation, 81, 83
- R-77 missile, 18  
 Rabin, Yitzhak, 174  
 RAD-Bynet, 191  
 Rafael, 172, 175, 177–8, 189, 191  
 Rafale, 136, 169  
 Raksha Udyog Ratnas (Champions of  
 Industry) (RUR), 148  
 RAND Corporation, 76  
 Ray, Christopher, 40, 75  
 Reagan National Defense Forum, 80  
 research, development, testing, and  
 evaluation (RDT&E), 56–7, 60, 92,  
 138  
 robotics  
 and 4IR, 22  
 and China's pursuit of MCF, 88, 113  
 and India's military doctrine, 158  
 and Israel's MCF, 193  
 and MCF, 36, 86  
 Roosevelt, Theodore, 53  
 Ross, Andrew L., 17  
 Rubin, Uzi, 185  
 Rufin, Carlos, 9  
 Rumsfeld, Donald, 77  
 Russia  
 defense conversion, 39  
 foreign technological dependency, 223  
 high-tech industry, 9  
 and MCF, 9, 222  
 national strategy and 4IR, 5–6
- Sa'ar-4/4.5 attack vessel, 173  
 Saab, 28, 40  
 Sagar Defence Engineering, 165  
 Samsung, 193  
 Sandia, 76  
 Saudi Arabia, 143, 206  
 Schwab, Klaus, 22  
 science and technology  
 dual-use, 45, 47  
 private firms, 55, 65, 83  
 US investments in, 60  
 Scitex, 191  
 Scorpène-class submarine, 133  
 Scout UAV, 174  
 SEMATECH, 45, 70  
 semi-automatic ground environment, 63  
 Shafrir-1 missile, 172  
 Shaked warfare system, 184

## 258 Index

- Sherlock Biosciences, 81  
 Shin-Bet, 186  
 Shivalik-class frigate, 133  
 Shraberg, Aaron, 110  
 Sikorsky, 102  
 Silicon Valley  
   and 3IR, 1  
   and CMI, 61–2  
   and MCF, 81  
   and spin-off technology, 30–1  
 Singh, J. P., 159  
 small- and medium-sized enterprises  
   (SME), 7, 211  
 smartphone, 41, 184  
 solid-state electronics, 62  
 South China Sea, 79, 219  
 South Korea  
   arms production and the state, 32  
   J/Vs in China, 107  
   private Sector's R&D expenditure, 10  
   pursuit of advanced military technology, 17  
   technological relations with United States, 72  
 Soviet Union, 28, 32, 90, 131  
 space launch vehicle, 107  
 Spanish–American War, 29, 51  
 spin-off technology, 38–40, 217  
   during the Cold War, 63  
   and conversion, 103, 190  
   and Israel high-tech industry, 191  
   and nuclear sector, 114  
 spin-on technology, 41  
   and armament sector, 114  
   and China's military modernization, 41–3, 94, 104, 107–8  
   before World War II, 59  
   during the 1990s, 72  
   in Israel, 199–201  
 spin-together technology, 20, 44  
 State Administration for Science, Technology and Industry for National Defense (SASTIND), 117–19  
 state capitalism, 11, 13  
 state-owned enterprise (SOE)  
   and China's defense industry, 90, 95–6  
   and India's defense industry, 137  
 Stockholm International Peace Research Institute (SIPRI), 92–3, 134, 137  
 Strategic Partnership (Model), 151  
 Su-30MKI fighter, 136  
 Suman, Marinal, 141, 144  
 Sun Zi, *see Art of War*  
 supply chain  
   civilian companies' participation in China's defense production, 123  
   civilian companies' participation in defense production, 7  
   Israel defense industry, 176, 180, 190  
   MCF and foreign infiltration to, 126  
   MCF and global technology decoupling, 222  
 Sweden, 26, 32, 40, 136  
 Switzerland, 10  
 Syria, 205  
 system-of-systems, 179, 197  
 T-55 tank, 131  
 T-72 tank, 131  
 T-80 tank, 169  
 Taiwan, 28, 32  
 Tarantul Corvette, 131, 134  
 Tata Group, 132, 153, 164, 211, 216  
 Technion, 194  
 Technology and Social Forecast Unit, 190  
 technology incubators, 1, 57, 107, 109, 216  
 Technology Reinvestment Project (TRP), 45, 71–2  
 Tejas fighter, 131, 136  
 telecommunication  
   and 3IR, 21  
   and China's MCF, 117  
   and CMI, 70  
   and spin-off technology, 30  
 Tencent, 12  
 terrorism, 5, 157  
 third offset strategy, 80–1, 220  
 Thirteenth Five-Year Special Plan for Science and Technology MCF Development, 47, 111  
 Tishler, Asher, 175  
 Tomer, 175  
 Toshiba, 193  
*Transforming the Defense Industrial Base: A Roadmap*, 78  
 Trishul missile, 132  
 Tyroler-Cooper, Rebecca Samm, 42  
 unicorn (start-ups), 12–13  
 United Aircraft Corporation, 108  
 United States  
   defense expenditures, 51, 60–2  
   foreign military sale (FMS), 174, 179  
   high-tech industry's contribution to military R&D, 72  
   military challenge to, 79  
   military implications of 4IR, 86, 219–20  
   military technology and high-tech industry, 64–6  
   military-technological innovation strategy, 60

- unmanned aerial vehicle (UAV)
  - 4IR, 24
  - and India's CMI, 163
  - India's arms imports, 137
  - Israel defense industry, 175
  - Israel's arms production, 174
  - and United States' MCF, 82
- unmanned vehicles, 219
- US Steel, 53
- Uzi submachine gun, 172
  
- Verma, Nirmal, 142
- Vickers, 53
- VideoRay, 81
- Vietnam War, 69
- Virtual Battle Space Mk.2 (VBS2), 82
- virtual reality, 30, 82, 165
- Visakhapatnam, 134
- VizExperts, 165
- Voss, Anthony, 38
  
- Walsh, Kathleen A., 60
- War of 1812, 51
- Warsaw Pact, 33
- warship
  - and early RMA, 27
  - China defense industry's reform and, 108
  - China defense industry's weakness and, 103
  - and India's CMI, 142
  - and modern defense industry, 26
  - and premodern CMI, 26
  - and United States' CMI, 49
- Washington Naval Treaty, 53
- Westinghouse, 31, 62
- wireless communication, 20, 30, 59, 65
- Work, Bob, 81
- World War I, 26–7, 29, 51, 53, 65
- World War II, 65
  - and early CMI, 59
  - expansion of defense industry, 7, 27
  - and US defense industry, 29, 54
  - and US military development, 52
  - and US military-aircraft sector, 53
- X-20 Dyna-Soar, 66
- Xi Jinping
  - initiation of MCF strategy, 19, 110, 210
  - personal commitment to MCF, 127, 214
  - prioritization of MCF strategy, 89, 210
- XP-9 fighter, 53
  
- Y1B-9 bomber, 53
- Yaakov, Yitzhak, 192
- Yaogan satellite, 108
- yujun yumin* (locate military potential in civilian capabilities), 41, 105
  
- Zisapel, Yehuda, 191
- Zisapel, Zohar, 191
- Ziyuan satellite, 108
- ZTE, 12