Index

academic system knowledge 4, 31, 32, 87, 183
adaptive reactions 10, 13, 42, 51, 129, 133
see also creative adoption; foreign technology adaptation
agricultural sector 115, 124, 125
Arora, A. 23, 26
Arrow, K.J. 15, 19, 20, 31, 58–9, 88
Atkinson, A.B. 15–16
automated numerically controlled machinery 125–6, 127, 129–30, 131
automotive industry 99, 100, 101
Becattini, G. 85–6
Belussi, F. 79–80, 81–2
biased technological change see directed technological change
bounded rationality 52–3
Bresnahan, T. 24, 25
bundling of knowledge 34, 36, 56, 57
capital 52, 90, 125, 126, 130, 150, 151
capital abundance 140, 142, 149
capital goods 37, 77, 111–12, 125–6, 127–30, 131–2, 133, 134, 135, 174
see also machinery
capital goods markets
Italian distributed model 75, 77, 81, 84, 85, 86, 88, 89, 90, 181, 182
knowledge generation and vertical dynamic interdependence 163, 164, 165, 174, 177
localized knowledge exploitation and appropriation 37
capital goods prices 130
capital goods sectors
Italian distributed model 75, 81, 84, 85, 86, 89, 90, 181, 182
knowledge generation and vertical dynamic interdependence 163, 164, 165, 174, 177
localized knowledge exploitation and appropriation 37
capital-intensive sectors 116, 117, 118, 119, 120
see also ferrous and non-ferrous metals industry; non-metalliferous minerals industry
capital-intensive technologies
capital supply 140, 142
Italian distributed model 181, 182
knowledge exploitation strategies and direction of technological change 139, 141–9, 154–9
knowledge generation and vertical dynamic interdependence 168, 169, 171–2, 173, 175, 176, 177
structural change and systemic interdependence in Italy 125, 127, 130, 133

capital–labour substitution 12, 38, 139, 142, 149, 150

capital productivity 142

capital scarcity 143

central Italy 88, 93, 97–8, 103, 106, 114, 115, 116, 128, 133, 149

see also north-central Italy

ceramics industry 78–9, 83–4, 89, 130, 132

Chandler, A.D. 29, 34, 135

clothing industry

see textiles and clothing industries

clustering 20, 46, 58–67, 87, 175

see also firm density; industrial districts

codified knowledge 27, 28–9, 30, 32, 87, 110, 111, 173

cognitive distance 32

Cohen, W.M. 21, 25, 30

communication channels 5, 13–14, 26, 42, 44, 46, 47, 81, 174, 177, 181

see also knowledge communication costs; knowledge interactions

competences 15, 16, 17, 27, 30, 36, 37, 53, 141, 148

see also human capital; qualified labour; skilled labour; skills; technical skills

complementary assets 34, 35

complementary knowledge see knowledge complementarity

complementary niche markets 78, 79, 80, 84, 86

complex systems 44, 55, 75–6, 82, 88

composition effects 116, 140

corporate model of localized technological knowledge generation 3, 28, 29, 87, 173, 183

creative adoption 5–6, 111, 112, 129–30, 135, 148, 154, 174, 175, 181, 184

creative reactions

Italian distributed model 5–6, 76, 85, 89–90, 181

localized technological change 10–14, 17, 18, 42

model of localized technological change 51, 67

pecuniary knowledge externalities 24

David, P.A. 24, 26, 38, 46, 48, 159

demand 5–6, 11, 12, 17, 22–3, 52, 174, 175, 176, 177
Index

see also demand pull; derived demand
demand pull
Italian distributed model 76, 77, 78, 85, 89, 181
knowledge generation and vertical dynamic
interdependence 163, 164, 165, 170–73, 177–8
downstream sectors 163–5, 166–73, 177–8
see also consumer goods sector
static pull
Durlauf, S.N. 44, 76
dynamic processes 38, 41, 44, 76, 79, 80, 84, 88
economic disequilibrium 10–14, 17, 42, 51, 53, 67
economic growth 1, 4, 22–3, 113–14, 168, 174, 175, 176, 177, 184
educational level 126–7, 132, 143, 174
see also human capital; skilled labour; technical secondary
education
efficiency
external knowledge in localized knowledge generation 44–5
Italian distributed model 85–6, 89
knowledge exploitation strategies and direction of technological change 150–53
knowledge generation and vertical dynamic interdependence in Italy 124, 130–31, 134, 135
localized knowledge exploitation and appropriation 36, 39
localized technological change and Total Factor Productivity 112–14
model of localized technological change 53
structural change and systemic interdependence in Italy 133
directed technological change 36–8, 39, 40, 43, 65–6, 68–9, 90, 125, 181
see also intentional decision-making; knowledge exploitation strategies and direction of technological change
distributed model of localized technological knowledge generation 24–30, 87
see also Italian distributed model of localized technological knowledge generation
division of labour
Italian distributed model 5, 78, 80, 83, 85–6, 89, 181, 182, 184
pecuniary externalities 22–3
division of labour
pecuniary knowledge externalities 47, 60
structural change and systemic interdependence in Italy 134
endogenous processes
communication networks 44
external knowledge 12–14, 41–2, 67
structural change and systemic interdependence in Italy 133
externalities 41

idiosyncratic production factors 83
national innovation systems 88
pecuniary knowledge externalities 13, 38, 41, 184
technological change 3, 12, 38, 134, 143, 159
entry barriers 34, 36, 39–40, 45, 64, 65
European markets 5–6
European Patent Office 103, 106
exclusivity 34, 35, 39, 59, 61
exports 129, 130
external codified knowledge 27, 28, 29, 30, 32, 87, 110, 111, 173
external knowledge
  corporate model 87
  distributed model of localized technological knowledge generation 26–30, 87
innovation systems 13–14, 41
Italian distributed model 3–4, 5, 29, 79, 82, 90, 183
knowledge governance costs 30–32
knowledge interactions 41
localized technological change 12–13, 111
localized technological knowledge generation 15, 17, 18
model of localized technological change 51–2, 53, 54, 55, 67, 68
as a public/quasi-public good 19–20
see also external codified knowledge; external knowledge costs; external tacit knowledge; pecuniary knowledge externalities
external knowledge costs 53, 54–6, 57, 60, 61, 62, 63, 64, 65, 67
external tacit knowledge 27, 28, 29, 30, 87, 173, 178
externalities 41, 49
see also external knowledge; pecuniary knowledge

pecuniary knowledge externalities; technological externalities

fashion industry 79–80
feedback 14, 37, 42, 77, 78, 83, 140, 173
see also innovation cascades; positive feedback
ferrous and non-ferrous metals industry
knowledge exploitation strategies and direction of technological change 145, 146, 147, 157, 158
knowledge generation and vertical dynamic interdependence 165, 166, 168, 171, 172
measures of innovative activity in Italy 116, 117, 118, 119

filières
Italian distributed model 4, 5, 76, 77, 78, 79–82, 83, 84, 85, 86, 182, 184
pecuniary externalities 22–3
pecuniary knowledge externalities 44
structural change and systemic interdependence in Italy 130, 131, 134, 135
see also knowledge generation and vertical dynamic interdependence
firm density 41, 46–8, 58–67
see also clustering; geographical proximity; industrial districts
firm size 85–6
see also large firms; medium-sized firms; small firms
firms see filières; firm density; firm size; incumbent firms; learning firms; myopic firms; new firms; resource-based theory of the firm; State owned enterprises (SOEs)
flexible production factors 52
food industry
  Italian distributed model 83–4, 89
knowledge exploitation
  strategies and direction of technological change 145, 157, 158
knowledge generation
  and vertical dynamic interdependence 165, 167, 169, 171, 172, 173
measures of innovative activity in Italy 107, 116, 117, 118, 119, 120
structural change and systemic interdependence in Italy 132
foreign non-incorporated technology acquisitions see Technological Balance of Payments (TBP)
foreign patent activity 102, 103–5
foreign technology adaptation 82, 125, 127, 131, 132, 133, 135, 153
foreign technology imports 127, 129, 132, 148
see also Technological Balance of Payments (TBP)
Fosfuri, A. 23, 26
France 95–6, 104, 109, 110, 113, 114
Freeman, C. 26, 31, 90
furniture industry see wood and furniture industries
Gambardella, A. 23, 24, 25, 26
GDP 93, 94, 95, 113, 174, 176, 177, 275
generic technological knowledge 20–21
generic technology 45
geographical proximity 31, 32, 41, 77, 80, 85
see also clustering; firm density; industrial districts
Germany 95–6, 102, 103, 104, 106, 109, 110, 113, 114
Griliches production function 56–8
Hayek, F.A. 25–6
Hicks, J.R. 12, 139, 141, 150, 159, 160
high-tech industries 4, 99, 118, 183
human capital 70, 126–7, 128
see also competences; qualified labour; skilled labour; skills; technical skills
idiosyncratic production factor prices 47, 48
idiosyncratic production factors and innovation systems 43–4
Italian distributed model 80, 83, 86, 90
knowledge exploitation
  strategies and direction of technological change 140, 141
localized knowledge exploitation and appropriation 35–6, 38, 39–40, 43, 59
localized technological knowledge generation 17, 18, 69
specific technological knowledge 20
idiosyncratic technology 45, 46, 77
imitation 19, 34, 132–3, 148
imitation barriers 34, 36, 39–40, 45, 59, 64, 65, 69
incumbent firms 34, 45
industrial districts
  distributed model 87
  Italian distributed model 4, 5, 76, 77, 78, 79–81, 82, 83, 85–6, 88–9, 181, 182, 184
knowledge generation
  and vertical dynamic interdependence 175
industrialization 148–9
innovation cascades 70, 77, 83, 84
innovation systems 13–14, 21, 22, 41–9, 58–67, 70
see also Italian distributed innovation system; national innovation systems
intellectual property 4–5, 59, 61, 69, 71
intentional decision-making
complementary knowledge in innovation systems 44
Italian distributed model 76
knowledge communication 31
localized knowledge exploitation and appropriation 35, 36–8, 39
localized technological knowledge generation 16–17, 18
pecuniary knowledge externalities 23, 24
technological paths in innovation systems 48
see also directed technological change
inter-industry knowledge interactions 4, 77, 78, 79, 80–81, 83, 184
intermediary goods 110, 111–12, 135, 174
intermediary goods markets
Italian distributed model 4, 5, 80, 81, 84, 85, 86, 88, 89, 90, 181, 182, 183
knowledge generation and vertical dynamic interdependence 163, 164, 165, 173, 174, 177
pecuniary externalities 23
intermediary goods sectors knowledge exploitation strategies and direction of technological change 154, 158
measures of innovative activity in Italy 99, 116, 117, 118, 119, 120
structural change and systemic interdependence in Italy 126, 134
see also ferrous and non-ferrous metals industry; non-metalliferous minerals industry; paper industry
internal codified knowledge 28, 29, 30
internal knowledge 13, 26, 27–9, 30, 32, 37, 53, 54, 55
internal knowledge costs 54
internal tacit knowledge 3, 28, 29, 30, 183
international markets 5–6, 85, 88, 163, 181
intra-industry knowledge interactions 4, 77, 78, 79, 80–81, 83, 184
invention/inventors 19, 20, 34, 35
investment
Italian distributed model 77, 78, 84–5, 89, 181
knowledge exploitation strategies and direction of technological change 148, 149
knowledge generation and vertical dynamic interdependence 163, 164, 173, 178
structural change and systemic interdependence in Italy 124, 125–30, 132
irreversibility of production factors 11, 12, 51–3
Istituti Tecnici Industriali 127, 131, 175, 176
Italian distributed innovation system 6, 87–90, 132–5, 180–85
Italian distributed model described 3–4, 5–6, 29, 75–90
case study evidence 78–82, 84–6
national innovation systems 6, 87–90, 132–5, 180–85
Japan 95–6, 102, 103, 104, 109, 110, 113, 114
Kaldor, N. 12, 23, 78, 89, 163
know-how 4, 110, 131
knowledge absorption costs 27, 54
knowledge accumulation 3, 25–6,
<table>
<thead>
<tr>
<th>Knowledge Appropriability</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Also</td>
<td>Localized Knowledge Appropriability</td>
</tr>
<tr>
<td>Knowledge Communication Costs</td>
<td>13,</td>
</tr>
<tr>
<td>Knowledge Complementarity</td>
<td>Distributed Model of Localized Technological Knowledge Generation</td>
</tr>
<tr>
<td>External Knowledge in Innovation Systems</td>
<td>43, 44, 45, 46, 48, 49</td>
</tr>
<tr>
<td>Internal and External Knowledge</td>
<td>26, 27, 29</td>
</tr>
<tr>
<td>Italian Distributed Model</td>
<td>29, 77, 81, 83, 86, 186</td>
</tr>
<tr>
<td>Knowledge Communication</td>
<td>31</td>
</tr>
<tr>
<td>Localized Knowledge Exploitation and Appropriation</td>
<td>37</td>
</tr>
<tr>
<td>Localized Technological Knowledge Generation</td>
<td>15</td>
</tr>
<tr>
<td>Model of Localized Technological Change</td>
<td>53, 58, 59, 67–8, 69</td>
</tr>
<tr>
<td>Pecuniary Knowledge Externalities</td>
<td>48, 49</td>
</tr>
<tr>
<td>Specific and Generic Technological Knowledge</td>
<td>20</td>
</tr>
<tr>
<td>Knowledge Districts</td>
<td>83</td>
</tr>
<tr>
<td>Knowledge Exploitation</td>
<td>See</td>
</tr>
<tr>
<td>Knowledge Exploitation Strategies and Direction of Technological Change</td>
<td></td>
</tr>
<tr>
<td>Effects of Biased Technological Change on Total Factor Productivity</td>
<td>150–59</td>
</tr>
<tr>
<td>Evidence for Bias in Favour of Capital-Intensive Technologies</td>
<td>141–9</td>
</tr>
<tr>
<td>Introduction</td>
<td>139–41</td>
</tr>
<tr>
<td>Knowledge Exploration</td>
<td>21, 29–30, 32, 35, 44</td>
</tr>
<tr>
<td>Knowledge Externalities</td>
<td>See</td>
</tr>
<tr>
<td>Knowledge Generation</td>
<td>27–30</td>
</tr>
<tr>
<td>See Also</td>
<td>Knowledge Generation and Vertical Dynamic Interdependence; Localized Knowledge Generation</td>
</tr>
<tr>
<td>Knowledge Generation and Vertical Dynamic Interdependence</td>
<td></td>
</tr>
<tr>
<td>Regional Evidence</td>
<td>174–8</td>
</tr>
<tr>
<td>Sectoral Evidence</td>
<td>162–74</td>
</tr>
<tr>
<td>Knowledge Generation Function</td>
<td>53–6</td>
</tr>
<tr>
<td>Knowledge Governance Costs</td>
<td>25, 26–7, 30–32, 43, 44, 47–8, 54–5, 57, 67, 69</td>
</tr>
<tr>
<td>Knowledge Indivisibility</td>
<td>25–6, 29, 42–3, 68</td>
</tr>
<tr>
<td>Knowledge Inputs</td>
<td>21, 26–9, 60, 68</td>
</tr>
<tr>
<td>Knowledge Integration</td>
<td>27, 28, 29, 31, 34, 35</td>
</tr>
<tr>
<td>Knowledge-Intensive Organization</td>
<td>4–5, 32, 83, 183</td>
</tr>
<tr>
<td>Knowledge Interactions</td>
<td>Distributed Model</td>
</tr>
<tr>
<td>External Knowledge</td>
<td>30–31, 41, 42</td>
</tr>
<tr>
<td>Italian Distributed Model</td>
<td>4, 5, 76, 77, 182</td>
</tr>
<tr>
<td>Localized Knowledge Exploitation and Appropriation</td>
<td>37</td>
</tr>
<tr>
<td>Model of Localized Technological Change</td>
<td>55, 59, 62–4, 67</td>
</tr>
<tr>
<td>Networking</td>
<td>31</td>
</tr>
<tr>
<td>Technological Knowledge Generation</td>
<td>28, 30</td>
</tr>
<tr>
<td>See Also</td>
<td>Communication Channels; Inter-Industry Knowledge Interactions; Intra-Industry Knowledge Interactions; Knowledge Communication Costs; User–Producer Interactions</td>
</tr>
<tr>
<td>Knowledge Non-Exhaustibility</td>
<td>21, 25, 54, 58</td>
</tr>
<tr>
<td>Knowledge Outputs</td>
<td>21, 26, 60, 68</td>
</tr>
<tr>
<td>Knowledge Outsourcing</td>
<td>4, 31, 32</td>
</tr>
<tr>
<td>Knowledge Prices</td>
<td>41, 60</td>
</tr>
</tbody>
</table>
knowledge rents 36, 39, 40, 61, 62, 65
knowledge substitutability 29
knowledge supply 60, 65
knowledge transactions 28, 30, 55, 67, 87

labour abundance 132, 140, 142, 143, 148, 154
labour cost increases
  - Italian distributed model 76

knowledge exploitation
  - strategies and direction of technological change 143, 146–7, 149, 153

knowledge generation
  - and vertical dynamic interdependence 173, 174, 176

model of localized technological change 52
structural change and systemic interdependence in Italy 130, 133

and technological innovation 12
see also wage per labour unit

labour cost reductions 86
labour-intensive technologies 140, 142, 143, 148, 153–4, 155–8

labour markets 85–6
labour mobility 59, 87
labour productivity 113, 124, 142, 168, 177

labour relations 85–6, 87, 124, 133
labour scarcity 124, 130, 133, 143, 149, 153–4

labour supply 52, 124, 125, 150, 151
see also capital–labour substitution; division of labour; human capital; labour abundance; labour markets; labour scarcity; labour value added share; qualified labour; skilled labour; unemployment

labour value added share 142, 144–5

Lane, D.A. 42, 76, 79, 82
large firms 3, 4, 34, 86, 87, 133, 134, 183
Lazio, Italy 93, 97–8, 99, 103, 106

learning
  - composition effects 140
  - distributed model 87
  - and external knowledge in innovation systems 44
  - Italian distributed model 3, 4, 29, 76–7, 79, 89, 182, 183

knowledge exploitation
  - strategies and direction of technological change 143, 148

knowledge generation
  - and vertical dynamic interdependence 163, 173, 174, 177

knowledge governance costs 32
localized knowledge exploitation and appropriation 35
localized technological change 111

localization
  - technological knowledge generation 15–16, 17, 18
  - structural change and systemic interdependence in Italy 132, 134, 135

Technological Balance of Payments in Italy 110
technological innovation 11, 12, 13
technological knowledge generation 27, 28, 29, 30
see also academic system
knowledge; learning firms; valorization of learning

learning firms 37, 75
Levinthal, D.A. 21, 25, 30
licences 30, 109, 110, 131, 133
Liguria, Italy 93, 97–8, 99, 106
local pools of knowledge

composition effects 140
distributed model of localized technological knowledge generation 27, 28
Index

external knowledge in innovation systems 44–5, 46
Italian distributed model 3, 77, 82, 84, 86, 90
model of localized technological change 53, 58, 59–60, 61–2, 64, 65, 66–7, 69
pecuniary knowledge externalities 47, 48, 58, 59–60, 61–2, 64, 65, 66–7
structural change and systemic interdependence in Italy 133
local product markets 18
local production factor abundance external knowledge in innovation systems 43
Italian distributed model 77, 80, 83, 86
localized knowledge exploitation and appropriation 36, 43, 46, 59
localized technological knowledge generation 16
model of localized technological change 59, 64, 65, 66, 69
structural change and systemic interdependence in Italy 135
local production factor markets 18, 140
see also capital goods markets; intermediary goods markets; labour markets
local resource endowments 69–70
localized knowledge appropriability 34–40, 43, 59–60, 61, 66, 69, 77, 141
localized knowledge appropriability reduction 59, 60, 61, 62, 63, 64, 65
localized knowledge exploitation complementary knowledge in innovation systems 44
external knowledge in innovation systems 43
idiosyncratic technology and locally abundant production factors 46
Italian distributed model 79, 80, 84, 86, 90
localized knowledge appropriability 34–40
localized technological knowledge generation 17
model of localized technological change 64–5
production costs 45
localized knowledge exploration 44
localized knowledge generation external knowledge in innovation systems 44–5, 46
knowledge exploitation strategies and direction of technological change 141
localized technological innovation 15–18
model of localized technological change 53–6, 67, 68–9
specific and generic technological knowledge complementarity 20
localized paths of technological change 69–70
localized technological change 10–14, 17, 18, 24, 42, 111–21, 180–81, 184–5
see also model of localized technological change
Lombardia, Italy 93, 97–8, 99, 106, 114
machine tools industry 83–4, 99, 101, 130, 131
machinery 125–6, 127, 129–30, 131, 148, 149, 154, 159
machinery capital intensity 168, 169, 171–2, 173, 177, 178
machinery industry Italian distributed model 4, 78, 80–81, 83–4, 85
knowledge exploitation strategies and direction of technological change 154, 159
measures of innovative activity in Italy 99, 100, 103, 105, 106, 107, 110
structural change and systemic interdependence in Italy 127, 129–30, 131–2
manufacturing industries
Italian distributed model 79–80, 83–4, 85, 86, 88, 89
knowledge exploitation strategies and direction of technological change 142–9, 152–9
knowledge generation and vertical dynamic interdependence 163, 165–74, 175–8
measures of innovative activity in Italy 93, 99, 100, 101, 113, 114, 115, 116–20
structural change and systemic interdependence in Italy 124–6, 127, 130–32, 133–4
see also automotive industry; ceramics industry; chemical industry; design industry; electrical and electronic equipment industries; fashion industry; ferrous and non-ferrous metals industry; food industry; high-tech industries; mechanical engineering industry; non-metalliferous minerals industry; paper industry; plastics industry; precision instruments industry; rubber industry; textiles and clothing industries; transportation equipment industry; wood and furniture industries
March, J.C. 34, 37
Marche, Italy 98–9, 103, 106, 114
Marchionatti, R. 80
Marshall, A. 9, 20, 21–2, 41, 50
Marx, K. 12, 136, 139, 160
mass production 124, 148
Matsuyama, K. 23, 44
Maxfield, R. 79
measures of innovative activity in Italy
localized technological change and Total Factor Productivity (TFP) 1–2, 111–20
patents 102–8, 109, 110, 111, 112
R&D expenditures 1, 93–101, 111, 112
Technological Balance of Payments (TBP) 108–11
mechanical engineering industry
Italian distributed model 78, 80, 86, 88, 89
knowledge exploitation strategies and direction of technological change 143, 144, 146–7, 154, 155, 158
knowledge generation and vertical dynamic interdependence 163, 165–74, 175–8
structural change and systemic interdependence in Italy 131, 134
see also machine tools industry; machinery industry; robotics industry
medium-sized firms 85, 134
metals 107
see also ferrous and non-ferrous metals industry
minerals see ferrous and non-ferrous metals industry; non-metalliferous minerals industry
model of localized technological change
basic model 51–3
conclusions 67–71
dynamic interplay between
positive and negative pecuniary knowledge externalities 58–67
Griliches production function 56–8
knowledge generation function 53–6
modern sectors
knowledge exploitation strategies and direction of technological change 143, 148, 154, 158, 159
structural change and systemic interdependence in Italy 133–4
Total Factor Productivity 116–18, 119, 120
see also chemical industry; high-tech industries; mechanical engineering industry; rubber industry; transportation equipment industry
monopolistic prices 59, 61, 65–6
myopic firms 52–3
national innovation systems 6, 26, 87–90, 132–5, 180–85
negative pecuniary externalities 22
negative pecuniary knowledge externalities 47–8, 58–60, 61–2, 63, 64, 65–6
Nelson, R. R. 19, 25, 38, 53, 55, 90
net pecuniary knowledge externalities 60–64, 65–6
Netherlands 105, 113
networking costs 27, 30, 54
networks 11, 13–14, 31, 76
new biased technologies 36, 69, 150
new firms 34, 62–4, 65, 133, 149
see also new knowledge-intensive firms; new specialized firms
new growth theory 19–21, 70, 180
new knowledge-intensive firms 79
new specialized firms 4, 5, 80, 81, 86, 88–9
new technological knowledge 13, 53, 54, 55, 56, 57, 61
see also localized knowledge generation
nodes 46, 47
non-metalliferous minerals industry 116, 117, 119, 145, 157, 158, 165, 166, 168, 171
non-rivalry of knowledge exchange and use 59
north Italy 88–9, 93, 97–8, 99, 103, 106
northeast Italy 88, 93, 97–8, 99, 103, 106, 114, 115, 116, 128, 133, 148–9
northwest Italy 88–9, 93, 97–8, 99, 103, 106, 114, 115, 116, 128, 133
open innovation model 4–5, 183
opportunity costs 120
optimum cluster size 41, 48
optimum knowledge pool size 61, 66–7
organized structures, Italian distributed model 76
output 60, 61, 150–51
output growth 1, 71, 163–4, 168, 177
paper industry
knowledge exploitation strategies and direction of technological change 145, 157, 158
knowledge generation and vertical dynamic interdependence 165, 167, 169, 171, 172
measures of innovative activity in Italy 116, 117, 118, 119, 120
structural change and systemic interdependence in Italy 130
Parisi, M. L. 84–5, 112
past dependence 45, 48, 88
patents
corporate model 87
as external knowledge 30
Italian distributed model 79
knowledge generation
and vertical dynamic
interdependence 168, 169,
170, 171–2, 173
measures of innovative activity
in Italy 102–8, 109, 110, 111,
112
structural change and systemic
interdependence in Italy 131,
133
path dependence 17, 38, 43, 45, 48,
55, 69–70, 88, 140
Patrucco, P.P. 29, 80–81, 86
pecuniary externalities 22–3
pecuniary knowledge externalities
adaptive reactions 13
distributed model of localized
technological knowledge
generation 25, 27
environmental contexts 32
e external knowledge in innovation
systems 43, 44
and innovation systems 21, 22,
41, 42–3, 46–7, 70
Italian distributed model 76, 77,
81, 82–3, 86, 89–90, 183–4,
185
knowledge complementarity 48,
49
knowledge exploitation
strategies and direction of
technological change 139–40,
141
knowledge generation
and vertical dynamic
interdependence 163, 164,
165, 170, 173, 174, 175–6
localized knowledge exploitation
and appropriation 35, 36,
38–9
localized technological knowledge
generation 21, 22
model of localized technological
change 54–6, 57–67,
69
positive and negative effects of
firm density 46–8, 58–67
relevance 23–4
structural change and systemic
interdependence in Italy 131,
134, 135
synchronous knowledge
indivisibility 27, 68
versus technological externalities
68
see also negative pecuniary
knowledge externalities;
net pecuniary knowledge
externalities; positive
pecuniary knowledge
externalities
Penrose, E.T. 16
perfect competition 59, 61
Piemonte, Italy 93, 97–8, 99, 103,
106, 114
plastics industry 80–81, 101, 130
polycentric character 29, 55, 76–7,
86, 177, 182, 183
positive feedback 46, 56, 58, 85, 88,
181
positive pecuniary externalities 22
positive pecuniary knowledge
externalities 47–8, 55–6, 60, 61,
62–4, 65
precision instruments industry 100,
106, 107, 132
private sector 93, 96, 115, 133
process innovations 78, 79, 84–5,
89, 139, 149, 163, 178, 181, 182
Prodi, R. 78
product innovations 84–5, 89,
132–3, 134, 148, 149, 163, 178
product prices 45, 48, 59, 61–2, 64,
65–6
production cost increases 53
production cost reduction
external knowledge in innovation
systems 43, 45
Italian distributed model 77
knowledge exploitation
strategies and direction of
technological change 140–41
knowledge generation
and vertical dynamic interdependence 164
localized knowledge exploitation
and appropriation 36, 39, 43
model of localized technological change 62, 63, 66, 69
production costs 45
production factor costs 143
production factor intensive use
external knowledge in innovation systems 43, 45
Italian distributed model 77, 80, 83, 86
knowledge exploitation
strategies and direction of technological change 141
localized knowledge exploitation
and appropriation 35–6, 37, 38, 39–40, 43
localized technological knowledge generation 15, 16
model of localized technological change 64, 65, 66, 69
production factor prices 11, 12, 17, 22, 23, 38, 39, 150
production factor substitution 12, 38, 139, 142, 149, 150
production factors 20, 57, 58
see also capital; capital goods markets; idiosyncratic production factors;
intermediary goods markets; labour markets; labour supply; local production factor abundance;
production factor intensive use; production factor prices; production factor substitution
production functions 56–8, 141–2, 150–53
productivity 140, 150, 168, 181
see also capital productivity; labour productivity; output growth; Total Factor Productivity (TFP)
profitability valuation 37–8
proximity 79–80
see also cognitive distance; geographical proximity; relational proximity
public funding 93, 133, 183
public goods 19–20
public research institutes 32, 87
qualified labour 30, 59, 127
see also competences; human capital; skilled labour; technical skills
R&D
corporate model 3, 87, 173, 183
Italian distributed model 83, 84–5
model of localized technological change 53
structural change and systemic interdependence in Italy 131, 133
technological knowledge generation 27, 28, 29, 30
R&D expenditures 1, 77, 93–101, 111, 112
reciprocity 30, 82, 83–4
recombination processes 5, 15, 21, 26, 29, 31, 110, 111, 183, 184
recursive processes 41–2, 181
regions of Italy see central Italy; Emilia-Romagna, Italy; Lazio, Italy; Liguria, Italy; Lombardia, Italy; Marche, Italy; north Italy; north-central Italy; northeast Italy; northwest Italy; Piemonte, Italy; Sassuolo, Italy; south Italy; Toscana, Italy; Veneto, Italy
relational proximity 77, 80
relationships 30
see also knowledge interactions; networks; reciprocity; relational proximity; user–producer interactions
repeated interactions/transactions 5, 31, 59, 81
research centres 26, 30, 32, 87, 131
resistance to change 17
resource-based theory of the firm 16, 70
revenues 62, 63, 65, 66
rivalry of knowledge exchange 59
robotics industry 101
rubber industry
corporate model of localized technological knowledge generation 173
knowledge exploitation strategies and direction of technological change 143, 144, 146–7, 154, 156, 158
knowledge generation and vertical dynamic interdependence 165, 167, 169, 171, 172, 173
measures of innovative activity in Italy 100, 101, 107, 116–18, 119, 120
Russo, M. 78–9
Sassuolo, Italy 78–9
Schumpeter, J.A. 9, 10–11, 17, 34, 46, 59
Scitovsky, T. 22, 33
search 13, 24, 30, 31, 34, 35, 36, 44, 46
search costs 13
sectors
knowledge exploitation strategies and direction of technological change 142–3, 154
knowledge generation and vertical dynamic interdependence 162–74
see also agricultural sector; capital goods sector; downstream sectors; intermediary goods sectors; manufacturing industries; modern sectors; private sector; traditional sectors; upstream sectors
selective strategies 18, 35, 38, 40, 46, 140–41
semi-skilled labour 132, 135, 148, 154
skilled labour 13, 83, 87, 127, 132, 153–4, 159
skills 27, 69–70
see also competences; human capital; skilled labour; technical skills
small firms external knowledge 15
Italian distributed model 3, 4, 5, 81–2, 83, 86, 101, 183, 184
structural change and systemic interdependence in Italy 133, 134
Solow, R.M. 122, 123, 151, 152
south Italy 88, 93, 97–8, 99, 103, 106, 114–15, 116, 128, 175–6, 177
South Korea 102, 105
southeast Italy 88, 115
southwest Italy 115
Spain 95, 105
specialization external knowledge in innovation systems 43
Italian distributed model 4, 5, 78, 80, 81, 83, 84, 85–6, 88, 89, 101, 106–7, 181, 182, 183, 184
measures of innovative activity in Italy 101, 106–7, 109–10, 116
pecuniary externalities 22–3, 38
structural change and systemic interdependence in Italy 130, 131, 135
specific technological knowledge 20
State owned enterprises (SOEs) 133, 134
Index

Stiglitz, J.E. 15–16
structural change 86
1990s 125, 126, 127, 128, 129, 135, 141
Sweden 105
Switzerland 104
synchronic knowledge integration 25–6, 27, 68
tacit knowledge
distributed model 87
Italian distributed model 5, 81, 86 localized knowledge exploitation and appropriation 37 localized technological knowledge generation 15, 17 technological innovation 12 technological knowledge generation 27, 28–9, 30 technical assistance 109, 110, 131 technical secondary education 127, 128, 131, 175, 176, 177 technical skills 143, 148, 168, 169, 170, 171–2, 173, 174, 175–6, 177
Italian distributed model 4, 83–4, 88–9 knowledge exploitation strategies and direction of technological change 143, 148, 149, 154, 157, 158 measures of innovative activity in Italy 101, 108, 116, 117, 118, 119, 120 structural change and systemic interdependence in Italy 125–6, 131, 133, 134 see also consumer goods sector; food industry; textiles and...
The dynamics of knowledge externalities

clothing industries; wood and furniture industries
traditional technologies 110
transaction-based interactions 5, 82, 182, 183
transaction costs 13, 27, 30, 81
transportation equipment industry
corporate model of localized technological knowledge generation 173
knowledge exploitation strategies and direction of technological change 143, 144, 146–7, 154, 156
knowledge generation and vertical dynamic interdependence 163, 165, 166, 168, 170, 171, 172, 173
measures of innovative activity in Italy 93, 100, 101, 106, 107, 116–18, 119
structural change and systemic interdependence in Italy 132
trust 30, 32, 82
UK 95–6, 104, 113, 114
unemployment 12
universities see academic system knowledge
upstream sectors 163, 164–5, 166–73, 174, 177, 178
see also capital goods sectors; intermediary goods sectors
USA 95–6, 102, 103–5, 113, 114, 133, 183
user–producer interactions
distributed model 87
external knowledge 31
Italian distributed model 4, 5, 76, 77, 78, 79–81, 82, 83, 84, 85, 86, 88, 89, 90, 181, 182, 183, 184
knowledge exploitation strategies and direction of technological change 139
knowledge generation and vertical dynamic interdependence 164, 173, 177
structural change and systemic interdependence in Italy 131, 134, 135
USPTO 102, 103, 104–5, 107
valorization of learning distributed model 87
Italian distributed model 3, 82, 85
localized knowledge exploitation and appropriation 36, 37
localized technological knowledge generation 15
model of localized technological change 53
structural change and systemic interdependence in Italy 133
Technological Balance of Payments in Italy 111
value added (VA) share
knowledge exploitation strategies and direction of technological change 158
knowledge generation and vertical dynamic interdependence 164–5, 166–8, 169, 170, 171–2, 173
measures of innovative activity in Italy 114–15, 116, 118–20, 158
Veneto, Italy 98–9, 103, 106, 114
vertical transmission mechanisms 22–3, 31, 149, 182
see also knowledge generation and vertical dynamic interdependence
wage per labour unit
Italian distributed model 76, 86, 182
knowledge exploitation strategies and direction of technological change 143, 146–7
knowledge generation and vertical dynamic
Index

interdependence 168, 169–70, 171–2, 173, 175, 176, 177
model of localized technological change 52
structural change and systemic interdependence in Italy 124, 126, 130, 132, 133
technological innovation 12
see also labour cost increases; labour cost reductions
wage reductions 86
Weitzman, M.L. 21, 26, 29, 53, 55
Williamson, O.E. 30
Winter, S.G. 38

wood and furniture industries
Italian distributed model 83–4, 89
knowledge exploitation
strategies and direction of technological change 143, 145, 154, 155, 158
knowledge generation
and vertical dynamic interdependence 163, 165, 167, 169, 171, 172, 173
measures of innovative activity in Italy 116, 117, 118, 119, 120
structural change and systemic interdependence in Italy 130, 132