

Contents

	<i>Acknowledgements</i>	ix
1	Blockchain Technology	1
	I Structure of the Book	4
	II Blockchains and Other Forms of Distributed Ledger Technology	6
	A Definition	6
	B History and Evolution	8
	C Blockchains as an Accounting System	10
	D Blockchains as Application Infrastructure	11
	E Algorithmic Trust	12
	F A Large Variety of Blockchains	14
	G Cryptoassets	16
	H Decentralization and Disintermediation	18
	I Consensus Protocols	19
	J Decentralized Applications and D(A)Os	22
	K Smart Contracts	24
	L Cryptography and Cryptoeconomics	28
	M Blockchains as Tamper-Proof Systems	30
	N Technical Immaturity	31
	O Malleability	33
2	Blockchains as a Regulatable Technology	34
	I Blockchains as the New Sealand?	36
	II Regulating Code	39
	A Code as Law	39
	B Law Constraining Code	40
	C Code as Law Avoidance	41

D Code Can Help Law	43
E Code Needs Law	44
III The Regulatory Access Points of the Blockchain Space	45
A Internet Service Providers	47
B Miners	49
C Core Software Developers	52
D End Users	53
E Old and New Intermediaries	55
F Governments as Blockchain Participants	57
IV The Difficulties of Blockchain Regulation	58
A Blockchains as Transnational Constructs	58
B Decentralization	60
C Anonymity	63
D Increased Adoption	64
3 Blockchains as a Regulatory Technology	66
I Code as Law	68
A Code as a Form of Private Ordering	68
B Code as Public Ordering	70
II Blockchain Code as Law	72
A The Emergence of a New Form of Law	73
1 Automated Enforcement	75
B Customized Legal Orders	78
III From Legal Code to Technical Code	80
IV The Necessary Interoperability of On-Chain and Off-Chain Law	84
4 Blockchains and the General Data Protection Regulation	88
I Personal Data on Blockchains	90
II The European Union's General Data Protection Regulation	91
A The GDPR's Material Scope: Does Data Stored on a Blockchain Qualify as Personal Data?	92
1 Personal Data Stored on a DLT	93
2 Public Keys	96
III Applying the GDPR to Blockchains	99
A The Data Controller(s)	99
B The GDPR's Territorial Scope	102
C Enforcing Substantive Data Protection Rights on Blockchains	103
1 Data Minimization	104
2 The Right to Amendment	104
3 The Right to Access	105

4	The Right to Be Forgotten	106
5	Data Protection by Design and Data Protection by Default	108
IV	Blockchains as an Innovation in Data Protection?	110
A	Reconciling Fundamental Rights Protection and the Promotion of Innovation	110
B	Blockchains as a Mechanism of Data Sovereignty	113
V	The GDPR and the Future of Blockchain Technology	115
5	Blockchains and the Idle Data Economy	117
I	Idle Data	119
II	The Legal Treatment of Non-Personal Data under EU Law	121
A	The Database Directive	121
B	The Essential Facilities Doctrine	124
C	Sector-Specific Solutions	125
D	The General Data Protection Regulation as a General Data Law?	127
1	Data Portability	127
2	The GDPR as the European Union's General Data Law?	129
E	Property Rights in Data	131
III	Access over Ownership	133
IV	Blockchains as a Technical Solution to the Data Access Problem?	134
V	Blockchains as a Tool of Data Governance	140
6	Blockchains, Law and Technological Innovation	142
I	Regulation, Innovation and Technology	145
A	Public Authorities as Participants in the Innovation Process	146
1	Research Finance and Investments	147
2	Early Adoption	148
3	The Provision of Information	149
B	Regulation as a Motor of Innovation	150
1	Promoting Legal Certainty	150
2	Creating a Market for a New Technology	151
3	Ensuring the Interoperability between New Technologies and Existing Law	152
4	Generating User Trust	152
II	Examples of Blockchain Regulation to Date	153
A	Wait and See	154
B	The Application of Existing Legal Frameworks	155
C	Issuing Guidance	157
D	Regulatory Sandboxes	158
E	Regulatory Cooperation	160
F	New Legislation	161

III	Polycentric Co-Regulation	165
	A Command-and-Control Legislation	165
	B Self-Regulation	167
	C Polycentric Co-Regulation	171
	1 Co-Regulation	172
	2 Polycentricity	176
	3 Coupling Co-Regulation with Technology	178
	4 The 28th Regime	180
7	Blockchain Governance	182
	I The Principles of Blockchain Governance	183
	II The Necessity of Governance Processes	186
	A The ‘The DAO’ Hack	187
	B The Bitcoin Block Size Debate	189
	III The Mechanisms of Blockchain Governance	191
	A Process versus Design	191
	B On-Chain versus Off-Chain Governance	192
	IV The Layers of Blockchain Governance	195
	A The Network Layer	195
	1 Permissioned Blockchains	195
	2 Unpermissioned Blockchains	197
	B Governance of the Application Layer	197
	C Blockchain Intermediaries	198
	V The Governance Processes of Permissionless Blockchains	198
	A Core Software Developers	199
	B Miners	201
	C Coin Holders	203
	D Other Governance Participants	204
	VI What Decentralization?	205
	VII Law as an Exogenous Factor of Blockchain Governance	206
	VIII The Importance of Governance for Blockchains’ Future	208
8	Conclusion	210
	<i>Index</i>	213