

Innovation, Technology, and Knowledge Management

Series editor

Elias G. Carayannis
School of Business
George Washington University
Washington, D.C., USA

More information about this series at <http://www.springer.com/series/8124>

Martin Curley • Bror Salmelin

Open Innovation 2.0

The New Mode of Digital Innovation
for Prosperity and Sustainability

 Springer

Martin Curley
Innovation Value Institute
Maynooth University
Maynooth, Kildare, Ireland

Bror Salmelin
DG Communications Networks
Contents and Technology, EU Commission
Brussels, Belgium

ISSN 2197-5698 ISSN 2197-5701 (electronic)
Innovation, Technology, and Knowledge Management
ISBN 978-3-319-62877-6 ISBN 978-3-319-62878-3 (eBook)
DOI 10.1007/978-3-319-62878-3

Library of Congress Control Number: 2017948655

© Springer International Publishing Switzerland 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

Two key words during my Presidency of the European Committee of the Regions (CoR) have been innovation and digitalization. The world around us and our conception of it are changing with accelerating speed. The new major success factor not only for industry but also for cities and regions is speed or better said velocity. Dramatic changes are posing both practical and exceptional theoretical and systemic challenges. The paradigms are changing from industrial society through information society to knowledge and innovation society so profoundly and quickly that it is hard to keep pace with them and make sense of the unparalleled transformations.

This changing landscape forms an excellent frame and reasoning to read this book, written by Professor Martin Curley and Bror Salmelin. Europe needs renewal through a new entrepreneurial mind-set and digitalization.

I am convinced that a Digital Europe based on in-depth bench learning and partnerships between cities and regions is becoming a reality. The CoR has challenged all the cities and regions in Europe to take stronger actions in becoming forerunners, especially in tackling societal challenges and in creating sustainable growth and new jobs. Let us learn what recent industrial and public sector practice has to offer for the European renewal.

Let us speed up the digital transformation by integrating the industrial experiences with the evidence-based knowledge, i.e., best practices and concepts, to operate via European digitalized open innovation platforms and thus getting new European innovations faster to the global markets.

The learnings can be extended beyond Europe, and in a new VUCA (volatility, uncertainty, complexity, and ambiguity) world, extraordinary leadership is called for to help guide us all to a better place. Digital technologies form the essential foundation for inventing the future. This book sheds light on the path to how we can collectively both simultaneously drive economic growth and improve society in a sustainable way.

Creating an understanding of the nature of disruptive change is the driver for providing sustainable benefits for society and global businesses. Let me encourage you to read and learn from what Martin Curley and Bror Salmelin have written. This

book can be a strong push forward in your personal knowledge sharing and co-creation process.

European Committee of the Regions
Bruxelles, Belgium

Markku Markkula

Dedication and Acknowledgments

This book is a synthesis of much work, research, and experience from various innovation landscapes, and we thank all who have contributed.

Martin:

To my family for all their support for which I am very grateful,

For surgeons Brian Mehigan and Donal Maguire and their colleagues for their brilliant work and care,

To the memory of Pauline Carbury and Alice Flanagan, a lovely woman and a lovely child who both left this world too soon,

For the OI2 community for their energy and creativity in helping make a difference.

Bror:

This journey in innovation over the years has been supported by my family whom I thank wholeheartedly.

Inspiration has also been given from numerous discussion partners and friends reflecting the thoughts and encouraging to go further.

“Live life out of your imagination, not your history”

Stephen Covey

Series Foreword

The Springer book series *Innovation, Technology, and Knowledge Management* was launched in March 2008 as a forum and intellectual, scholarly “podium” for global/local, transdisciplinary, trans-sectoral, public–private, and leading/“bleeding”-edge ideas, theories, and perspectives on these topics.

The book series is accompanied by the Springer *Journal of the Knowledge Economy*, which was launched in 2009 with the same editorial leadership.

The series showcases provocative views that diverge from the current “conventional wisdom,” that are properly grounded in theory and practice, and that consider the concepts of *robust competitiveness*,¹ *sustainable entrepreneurship*,² and *democratic capitalism*,³ central to its philosophy and objectives. More specifically, the aim of this series is to highlight emerging research and practice at the dynamic intersection of these fields, where individuals, organizations, industries, regions, and nations are harnessing creativity and invention to achieve and sustain growth.

¹We define *sustainable entrepreneurship* as the creation of viable, profitable, and scalable firms. Such firms engender the formation of self-replicating and mutually enhancing innovation networks and knowledge clusters (innovation ecosystems), leading toward robust competitiveness (E.G. Carayannis, *International Journal of Innovation and Regional Development* 1(3). 235–254, 2009).

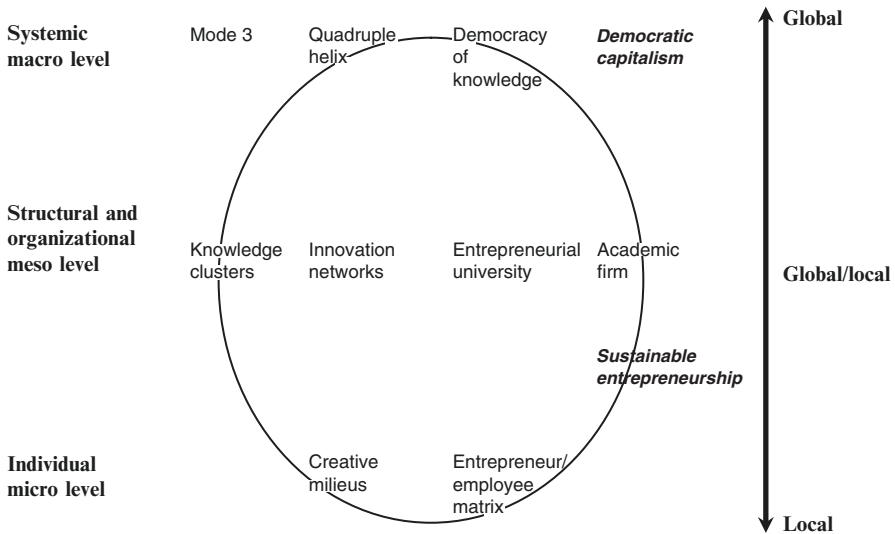
²We understand *robust competitiveness* to be a state of economic being and becoming that avails systematic and defensible “unfair advantages” to the entities that are part of the economy. Such competitiveness is built on mutually complementary and reinforcing low-, medium-, and high-technology and public and private sector entities (government agencies, private firms, universities, and nongovernmental organizations) (E.G. Carayannis, *International Journal of Innovation and Regional Development* 1(3). 235–254. 2009).

³The concepts of *robust competitiveness* and *sustainable entrepreneurship* are pillars of a regime that we call “*democratic capitalism*” (as opposed to “popular or casino capitalism”), in which real opportunities for education and economic prosperity are available to all, especially—but not only—younger people. These are the direct derivative of a collection of top-down policies as well as bottom-up initiatives (including strong research and development policies and funding, but going beyond these to include the development of innovation networks and knowledge clusters across regions and sectors) (E.G. Carayannis and A. Kaloudis, *Japan Economic Currents*. p. 6–10 January 2009).

Books that are part of the series explore the impact of innovation at the “macro” (economies, markets), “meso” (industries, firms), and “micro” levels (teams, individuals), drawing from related disciplines such as finance, organizational psychology, research and development, science policy, information systems, and strategy, with the underlying theme that for innovation to be useful it must involve the sharing and application of knowledge.

Some of the key anchoring concepts of the series are outlined in the figure below and the definitions that follow (all definitions are from E.G. Carayannis and D.F.J. Campbell, *International Journal of Technology Management*, 46, 3–4, 2009).

Conceptual profile of the series *Innovation, Technology, and Knowledge Management*



- The “Mode 3” Systems Approach for Knowledge Creation, Diffusion, and Use: “Mode 3” is a multilateral, multinodal, multimodal, and multilevel systems approach to the conceptualization, design, and management of real and virtual, “knowledge-stock” and “knowledge-flow,” modalities that catalyze, accelerate, and support the creation, diffusion, sharing, absorption, and use of cospecialized knowledge assets. “Mode 3” is based on a system-theoretic perspective of socio-economic, political, technological, and cultural trends and conditions that shape the coevolution of knowledge with the “knowledge-based and knowledge-driven, global/local economy and society.”
- Quadruple Helix: Quadruple helix, in this context, means to add to the triple helix of government, university, and industry a “fourth helix” that we identify as the “media-based and culture-based public.” This fourth helix associates with “media,” “creative industries,” “culture,” “values,” “lifestyles,” “art,” and perhaps also the notion of the “creative class.”

- **Innovation Networks:** Innovation networks are real and virtual infrastructures and infratechnologies that serve to nurture creativity, trigger invention, and catalyze innovation in a public and/or private domain context (for instance, government–university–industry public–private research and technology development cooperative partnerships).
- **Knowledge Clusters:** Knowledge clusters are agglomerations of cospecialized, mutually complementary, and reinforcing knowledge assets in the form of “knowledge stocks” and “knowledge flows” that exhibit self-organizing, learning-driven, dynamically adaptive competences and trends in the context of an open systems perspective.
- **Twenty-First Century Innovation Ecosystem:** A twenty-first century innovation ecosystem is a multilevel, multimodal, multinodal, and multiagent system of systems. The constituent systems consist of innovation metanetworks (networks of innovation networks and knowledge clusters) and knowledge metaclusters (clusters of innovation networks and knowledge clusters) as building blocks and organized in a self-referential or chaotic fractal knowledge and innovation architecture (Carayannis 2001), which in turn constitute agglomerations of human, social, intellectual, and financial capital stocks and flows as well as cultural and technological artifacts and modalities, continually coevolving, cospecializing, and cooperating. These innovation networks and knowledge clusters also form, reform, and dissolve within diverse institutional, political, technological, and socioeconomic domains, including government, university, industry, and non-governmental organizations and involving information and communication technologies, biotechnologies, advanced materials, nanotechnologies, and nextgeneration energy technologies.

Who is this book series published for? The book series addresses a diversity of audiences in different settings:

1. *Academic communities:* Academic communities worldwide represent a core group of readers. This follows from the theoretical/conceptual interest of the book series to influence academic discourses in the fields of knowledge, also carried by the claim of a certain saturation of academia with the current concepts and the postulate of a window of opportunity for new or at least additional concepts. Thus, it represents a key challenge for the series to exercise a certain impact on discourses in academia. In principle, all academic communities that are interested in knowledge (knowledge and innovation) could be tackled by the book series. The interdisciplinary (transdisciplinary) nature of the book series underscores that the scope of the book series is not limited a priori to a specific basket of disciplines. From a radical viewpoint, one could create the hypothesis that there is no discipline where knowledge is of no importance.
2. *Decision makers—private/academic entrepreneurs and public (governmental, subgovernmental) actors:* Two different groups of decision makers are being addressed simultaneously: (I) private entrepreneurs (firms, commercial firms, and academic firms) and academic entrepreneurs (universities), interested in optimizing knowledge management and in developing heterogeneously

composed knowledge-based research networks; and (2) public (governmental, subgovernmental) actors that are interested in optimizing and further developing their policies and policy strategies that target knowledge and innovation. One purpose of public *knowledge and innovation policy* is to enhance the performance and competitiveness of advanced economies.

3. *Decision makers in general:* Decision makers are systematically being supplied with crucial information, for how to optimize knowledge-referring and knowledge-enhancing decision-making. The nature of this “crucial information” is conceptual as well as empirical (case study-based). Empirical information highlights practical examples and points toward practical solutions (perhaps remedies); conceptual information offers the advantage of further-driving and further-carrying tools of understanding. Different groups of addressed decision makers could be decision makers in private firms and multinational corporations, responsible for the knowledge portfolio of companies; knowledge and knowledge management consultants; globalization experts, focusing on the internationalization of research and development, science and technology, and innovation; experts in university/business research networks; and political scientists, economists, and business professionals.
4. *Interested global readership:* Finally, the Springer book series addresses a whole global readership, composed of members who are generally interested in knowledge and innovation. The global readership could partially coincide with the communities as described above (“academic communities,” “decision makers”) but could also refer to other constituencies and groups.

Elias G. Carayannis

Preface

The way is long if one follows precepts (rules); the way is short if one follows patterns.
Seneca.

We are at a unique point in time where we have multiple disruptive technologies all showing up at the same time, creating a chain reaction of disruptive change. In this perfect storm, organizations and indeed ecosystems have a choice to react and let change happen or to proactively try to invent and innovate better outcomes. Open Innovation 2.0 (OI2) is the new paradigm and methodology for Digital Innovation. A new primordial soup exists which is bound by digital, enabled by digital, and fueled by digital where all actors in business and society have the opportunity to quickly create transformation solutions using agile methods. Based on our research and practice, we share the first version of an OI2 pattern language including core patterns to help innovators across the spectrum to increase the probability of success using a Digital platform and ecosystem approach. We have distilled these first patterns as we have observed the signals emerge from the noise in the rapidly exploding field of digital innovation. We present these initial patterns as a minimum viable platform (MVP) for OI2-led digital innovation, knowing instantly that almost before the ink is dry upon printing some of these will need to change as we learn and as dynamics change. We present the MVP OI2 pattern language to provide a rudimentary taxonomy and vocabulary to allow practitioners experiment and test these patterns with real-life projects and to give a base platform for researchers and practitioners to help expand and more fully describe the OI2 pattern language. Using the agile and rapid experimentation approach, we hope and expect that the OI2 pattern language will be iterated and improved quickly providing transformational value to governments, industry, academics, and citizens/users alike. Again using OI2 principles, we provide a “good enough” first version of the core patterns knowing already that there are omissions/errors rather than waiting for a much more polished version delivered later. We welcome your feedback and hope the book and associated body of knowledge are helpful to you.

Maynooth, Ireland
Brussels, Belgium
15 June 2017

Martin Curley
Bror Salmelin

Contents

1	Introduction	1
1.1	Simultaneous Arrival of Multiple Disruptive Technologies.	2
1.2	Evolution or Revolution? A New Paradigm.	2
1.3	Enabling Forces: A Perfect Storm	4
1.3.1	Moore’s Law/Digital.	4
1.3.2	Mass Collaboration.	5
1.3.3	Sustainability	6
1.4	Innovation Modes.	6
1.4.1	Dependency > Independency > Interdependency.	7
1.4.2	Subcontracting > Cross-Licensing > Cross-Fertilization	7
1.4.3	Solo > Cluster > Ecosystem	8
1.4.4	Linear > Linear, Leaking > Nonlinear Mash-Up	8
1.4.5	Control > Leadership/Management > Orchestration	8
1.4.6	Planning > Validation > Experimentation	9
1.4.7	Win-Lose > Win-Win > Win-More: Win-More	9
1.4.8	Box Thinking > Out of the Box > No Boxes	9
1.4.9	Single Entity > Single Discipline > Interdisciplinary.	10
1.4.10	Value Chain > Value Network > Value Constellation	10
1.5	Three Laws of Knowledge Dynamics	10
1.6	The Importance of Innovation	11
1.7	Basic Versus Applied Research and Innovation.	12
1.8	OI2: A New Mode of Technical and Societal Innovation and an Emerging Pattern Language	13
2	Digital Disruption	15
2.1	Pathways to the Digital Revolution	15
2.2	Disintermediation.	17
2.3	Distribution	17
2.4	Democratization.	17
2.5	Dematerialization.	18

- 2.6 Demonetization 19
- 2.7 Deceptive Displacement. 19
- 2.8 Attributes of Digital 19
 - 2.8.1 Malleable 20
 - 2.8.2 Programmable. 20
 - 2.8.3 Thinking 21
 - 2.8.4 Exponential. 21
 - 2.8.5 Interactive 21
 - 2.8.6 Ubiquitous 21
- 2.9 IT-CMF (Information Technology Capability Maturity Framework) 22
 - 2.9.1 IT-CMF Rationale and Summary 22
 - 2.9.2 Framework Description 24
- 3 Sustainable Intelligent Living 27**
 - 3.1 Sustainable Innovation 27
 - 3.2 Sustainable Intelligent Living 28
 - 3.2.1 Sharing Economy and Collaborative Consumption . . . 29
 - 3.3 Sustainable Development. 29
 - 3.4 Digital/Moore’s Law and Resource Decoupling 30
 - 3.4.1 Substitution, Automation, Dematerialization 32
 - 3.5 Servitization 32
 - 3.6 Digital and Sustainability. 33
 - 3.7 Plan C: Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. 33
 - 3.7.1 Cities as a Focal Point for Sustainable Intelligent Living 34
 - 3.8 Designing for Sustainability. 37
 - 3.8.1 High Frequency, High Precision Control Systems for Societal Level Systems. 37
- 4 The Evolution of Innovation 39**
 - 4.1 Defining Innovation 41
 - 4.2 Creative Disruption 42
 - 4.2.1 Innovation and Growth. 42
 - 4.3 Ten Types of Innovations: Full Spectrum Innovation 43
 - 4.4 The Extended Innovation Value Chain. 43
- 5 Framing OI2 47**
 - 5.1 Design Patterns. 48
 - 5.2 OI2 Core Patterns. 49
- 6 Shared Purpose 53**
 - 6.1 Shared Purpose. 53
 - 6.1.1 Shared Vision 55
 - 6.1.2 Shared Value 55
 - 6.1.3 Shared Values 56

6.1.4	Stored Value	58
6.1.5	Shareholder Value	58
6.1.6	Shared Value at Risk	59
7	Platforms	61
7.1	Architecture	62
7.2	Application Programming Interface	63
7.3	Governance	63
7.4	Networking and the Network Effect	64
7.5	Ease, Emergence, and Incentives	66
7.6	Industrial Mash-ups	66
7.7	Multi-Sided Platforms	67
8	Ecosystem Orchestration and Management	69
8.1	Partnering: Triple/Quadruple Helix Innovation	69
8.2	Citizens as Innovators	71
8.3	From Clusters to Open Innovation Ecosystems	73
8.3.1	Living Labs	74
8.4	Collaborative Architecture	77
8.5	Participative Architecture and Governance	78
8.6	Business Model Innovation	78
8.6.1	Business Model Experimentation	80
8.7	Ecosystem Development and Evolution	80
8.8	European Innovation Ecosystem and Scoreboard	81
8.9	The Entrepreneurial State	83
8.10	Policy: National Innovation Strategy	84
8.11	Co-creation	85
8.12	Visualizing Innovation Ecosystems	86
8.13	Intel Labs Europe Ecosystem Management	86
8.14	Makers and a New Innovation Ecosystem	87
8.15	Innovation Ecosystems Orchestration	88
9	Designing for Adoption	91
9.1	Utility	92
9.2	Uniqueness	93
9.3	Usability	93
9.4	User Experience	93
9.5	Ubiquity	94
9.6	User-Driven Innovation and the Reverse Innovation Pyramid	94
9.7	Reverse Innovation Pyramid	95
9.8	The Power of Crowds	96
9.9	Crowdfunding	97
9.10	Social or Peer Production	97
9.11	Adoption Pattern Analysis	98
9.11.1	API Adoption	98
9.12	Adoption Focus: Crossing the Chasm	99

- 10 Agile Development and Production** 101
 - 10.1 Agile Methods 101
 - 10.2 Design Science Research and Digital Assembly Lines 103
 - 10.3 Prototyping 104
 - 10.4 Minimum Viable Product 104
 - 10.5 Living Labs 106
 - 10.5.1 Living Labs in a European Context 106
 - 10.5.2 Open Innovation as Part of Living Labs Thinking 108
 - 10.6 Privacy by Design 109
 - 10.7 Productization and Proliferation 110
 - 10.7.1 DevOPs 110
 - 10.8 Servitization 110
- 11 Industrial Innovation** 113
 - 11.1 Visioning 113
 - 11.2 Strategic Innovation 113
 - 11.3 InVenting 115
 - 11.4 Validating 116
 - 11.5 Venturing 116
 - 11.6 Velocity 117
 - 11.7 Value 117
 - 11.8 New Innovation Value Constellations 118
 - 11.9 Industrializing Innovation: Innovation
Capability Management 119
 - 11.10 Innovation Systems 119
 - 11.10.1 Innovation Strategy and Innovation Capacity 119
 - 11.11 Industry 4.0 121
- 12 Data-Driven Innovation** 123
 - 12.1 Generating Insights from Data 124
 - 12.2 Augmenting Products/Services Using Data from Objects 125
 - 12.3 Digitizing Assets 125
 - 12.4 Increase Information Intensity 126
 - 12.5 Data Mining, Combining, and Refining 126
 - 12.6 Trading and Monetizing Data 127
 - 12.7 Closed Loop Control 127
- 13 Openness to Innovation and Innovation Culture** 129
 - 13.1 Technology Metabolism Index 130
 - 13.2 Operational Excellence Versus Innovation Excellence 130
 - 13.3 High Expectation Entrepreneurship 131
 - 13.3.1 Openness to Innovation: Managing Six
Vectors of Innovation 132
 - 13.4 Culture and Absorptive Capacity 133
 - 13.4.1 Social Innovation 134
 - 13.5 Interdisciplinary Innovation 134

- 13.6 Competitiveness of New Types of Organizations
in Open Ecosystems 136
- 13.7 OI2 Outputs 139
- 13.8 Payback–Return on Innovation 139
- 13.9 OI2 Outcomes 140
- 13.10 Fast and Slow Innovation Cycles..... 141
- 14 Looking Forward 143**
- References 145**

About the Authors

Martin Curley is Professor of Innovation at Maynooth University, Ireland. He is co-founder of the Innovation Value Institute, an industry-academic open innovation consortium that strives to research and promote structural change in the way companies and governments achieve value through information technology. He chairs the European Union Open Innovation Strategy and Policy group (OISPG), an industry-led group advising on strategic priorities for open and service innovation and is a member of the EU Connect Advisory Forum and the EU Horizon 2020 Advisory Group on international Cooperation. Martin is also Senior Vice President and Group Head for Global Digital Practice at MasterCard providing digital thought and practice leadership to MasterCard customers. Previously he was vice president at Intel Corporation and director of Intel Labs Europe, the company's network of more than 40 research labs, development centers and open innovation collaborations spanning the European region. He also served as a senior principal engineer at Intel Labs Europe and lead Intel's research and innovation engagement with the European Commission and the broader European Union research ecosystem.

Before assuming his current position in 2009, Curley was global director of IT innovation at Intel. Earlier in his Intel career, he held a number of senior IT management and automation positions for Intel in the United States and Europe. Before joining Intel in 1992, he held management and research positions at General Electric in Ireland and at Philips Electronics in the Netherlands. Curley is the author or co-author of five books and dozens of papers on technology management for value, innovation and entrepreneurship. He is a Member of the Royal Irish Academy, fellow of the Institution of Engineers of Ireland, the British Computer Society, the Irish Computer Society and the Irish Academy of Engineering. Martin was previously a visiting scholar at MIT Sloan Centre for Information Systems Research and was awarded joint European Chief Technology Officer of the year for 2015/2016.

Bror Salmelin is Advisor for Innovation Systems, DG Communications Networks, Contents and Technology at the European Commission. He was the deputy of the IT department of the Finnish Technology and Innovation Agency in 1984-97. In this capacity he represented Finland in the EU ESPRIT and ICT research programmes. He was the EFTA chair and co-designer of the global Intelligent Manufacturing Systems initiative since 1990. He was representing Finland in the Consulate of Los Angeles as Vice Consul in 1997-98 with the responsibility to build bridges between the Finnish and Californian innovation systems and moved in 1998 to European Commission to lead the units of Integration in Manufacturing, later eCommerce and Collaborative work before becoming advisor to the DG. He is the initiator of the European Network of Living Labs which now has more than 350 sites worldwide, and also the initiator of the Open Innovation activities in the European Commission. He is member of the New Club of Paris, IVI advisory board and founder of the EU OISPG.