Open Innovation Dynamics

Open Innovation Dynamics:

Capitalism, Socialism and Democracy in the 21st Century

First corresponding author and editor

Jinhyo Joseph Yun

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Capitalism, Socialism and Democracy in the 21st Century

Edited by Jinhyo Joseph Yun

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To my lovely daughter, Ayeong Veronica Yun for always supporting me throughout my research career

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SamYoul Lee, and Xiaofei Zhao

PRAISE FOR THE BOOK

Professor Loet Leydesdorff
Professor, University of Amsterdam
Amsterdam School of Communication Research (ASCoR)

"Joseph has provided us during the years with new ideas and initiatives for the innovation of innovations. As a community, we have been at the receiving end of this great service."

Professor Keun Lee
Distinguished Professor, Seoul National University
Editor of Research Policy, Winner of the 2014 Schumpeter Prize

"Adopting Schumpeterian economics, this book proposes a theoretical framework integrating technological catching-up and open innovation dynamics. Using the framework, the book does an excellent job of elaborating the logic and process of open innovation in the diverse contexts and domains, in particular its linkages to creating new business models through new combinations."

Professor Venni V. Krishna
Professorial Fellow, University of New South Wales, Sydney, Australia (2016-2024)
Editor-in-Chief, Science, *Technology & Society* (Sage Publications)

"The contents look very very impressive and I am sure it will get you a great honor and citations. My best wishes my friend for this fantastic hard work and themes are touching both history and contemporary phase of capitalism."

Professor Fred Phillips
Visiting Professor, College of Business, and Affiliate Faculty, Alan Alda Center for Communicating Science aldacenter.org, SUNY Stony Brook, former Editor-in-Chief of *Technological Forecasting and Social Change*

"JinHyo Joseph Yun's aim to "conquer the growth limits of capitalism," does not mean he despises regulations that hinder free competition. Rather, he argues that unfettered capitalism creates the very environmental crises that limit its growth. How can this limit be conquered? Dr. Yun and co-authors tell us that an entrepreneurial, open-innovation economy is a key part of the answer, and they give us solid philosophical support for this assertion."

Ulrich Witt
Professor of Economics, Director emeritus, Max Planck Institute of Economics Jena, Germany
Member of the Editorial Board Member of Evolutionary Economics, Associate Editor of *Journal of Bioeconomics*

"In this timely and thought-provoking volume Professor Jinhyo Joseph Yun, a renowned expert in open innovation research, and his co-authors present deep insights into the innovation dynamics of modern enterprises and economies. Reviewing their long-standing research, they offer the reader a unique synthesis of micro and macro perspectives on how new firms and industries emerge and jointly generate new wealth."

ABOUT THE EDITOR AND CONTRIBUTORS

Editor

Professor Dr JinHyo Joseph Yun
He is the editor of this book, and he is first and corresponding author of all 13 papers which are the source of the 13 chapters of this book.

He is a tenured principal researcher in Political Economics at Daegu Gyeongbuk Institute of Science and Technology (DGIST), a principal professor at the Open Innovation Academy (OIA), and the founding Editor-In-Chief (EIC) of Journal of Open Innovation; Technology, Market, and Complexity (JOI). And, he worked as a visiting professor at the Graduate School of Public Administration, Seoul National University (SNU) during editing of this book for one year.

Prof Dr. Yun's research vison, announced as the publishing goal of JOI, is "Let us conquer the growth limits of capitalism". The vision includes "conquering the growth limits of capitalism in social, economical and environmental aspects altogether". Moreover, he also wants to conquer the limits of economics in the 21st century according to the perspectives of Schumpeterian, Keynesian, and Political Economic Perspectives in addition to the post positivism research methods. This involves diverse qualitive methods such as in-depth interview, participatory observation, content analysis, focus group interview, as well as various simulation methods and new methods including agent-based modeling, system dynamics analysis, network analysis, big data analysis, and artificial intelligence approach. He founded the Society of Open Innovation; Technology, Market, and Complexity (SOI, www.openinnovation tmc.org) as another way to realize his research vision alongside

internationally renowned scholars who joined JOI as the editorial board. All co-authors of this book are members of the SOI or JOI editorial team.

The representative research outcomes of Prof Dr JinHyo Joseph Yun include more than 100 peer-reviewed papers published in *Technological Forecasting & Social Change*, *European Planning Studies*, *Knowledge Management Research & Practices*, *Science, Technology and Society*, *Cities*, etc. in addition to several Korean top journals and more than 10 books. The selected research papers and books are as follows.

Yun, JinHyo Joseph. 2017. *Business Model Design Compass: Open Innovation Funnel to Schumpeterian New Combination Business Model Developing Circle*. Singapore: Springer.

Yun, Jinhyo Joseph, Jeong Euiseob, Kim Sangwoo, Ahn Heungju, Kim Kyunghun, Hahm Sung Deuk, and Park Kyungbae. 2021. "Collective Intelligence: The Creative Way from Knowledge to Open Innovation." *Science, Technology and Society*, Vol. 26 No.2: 201-222.

Yun, JinHyo Joseph, Zhao Xiaofei, Park KyungBae, Del Gaudio Giovanna, and Sadoi Yuri. 2021. "New Dominant Design and Knowledge Management; a Reversed U Curve with Long Head and Tail." *Knowledge Management Research & Practice*, Vol.1 No.1: 1-15.

Yun, JinHyo Joseph, Park KyungBae, Del Gaudio Giovanna, and Della Corte Valentina. 2020. "Open Innovation Ecosystems of Restaurants: Geographical Economics of Successful Restaurants from Three Cities." *European Planning Studies*. Vol.28 No.12: 2348-2367.

Yun, JinHyo Joseph, Won DongKyu, Park KyungBae, Jeong EuiSeob, and Zhao Xiaofei. 2019. "The Role of a Business Model in Market Growth: The Difference Between the Converted Industry and the Emerging Industry." *Technological Forecasting & Social Change*,

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Yun, Jinhyo Joseph, Egbetoku Abiodun A., and Zhao Xiaofei. 2019. "How Does a Social Open Innovation Succeed? Learning from Burro Battery and Grassroots Innovation Festival of India." *Science, Technology and Society*, Vol.24 No.1: 122-143.

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Yun, Jinhyo Joseph, Park KyungBae, Im ChoongJae, Shin ChangHwan, and Zhao Xiaofei. 2017. "Dynamics of Social Enterprises—Shift from Social Innovation to Open Innovation." *Science, Technology and Society*, Vol.22 No.3: 425-439.

Yun, JinHyo Joseph, Cooke Philip, and Park JiYoung. 2017. "Evolution and Variety in Complex Geographies and Enterprise Policies." *European Planning Studies*, Vol.25 No.5: 729-738.

Yun, JinHyo Joseph, Won DongKyu, Park KyungBae, Yang JeongHo, and Zhao Xiaofei.2017. "Growth of a Platform Business Model as an Entrepreneurial Ecosystem and Its Effects on Regional Development." *European Planning Studies*, Vol.25 No.5: 805-826.

Yun, JinHyo Joseph, Won DongKyu, Jeong EuiSeob, Park KyungBae, Yang JeongHo, and Park JiYoung. 2016. "The Relationship Between Technology, Business Model, and Market in Autonomous Car and Intelligent Robot Industries." *Technological Forecasting & Social Change*, Vol.103: 142-155.

Yun, Jinhyo Joseph, Park Kyungbae, Kim Janghyun, and Yang Jeongho. 2016. "Open Innovation Effort, Entrepreneurship Orientation and Their Synergies onto Innovation Performance in SMEs of Korea." *Science, Technology and Society*, Vol.21 No.3: 366-390.

Yun, Jinhyo Joseph, and Park Kyungbae. 2016. "How User Entrepreneurs Succeed: The Role of Entrepreneur's Caliber and Networking Ability in Korean User Entrepreneurship." *Science, Technology and Society*, Vol.21 No.3: 391-409.

Yun, Jinhyo Joseph, Yang Jeongho, and Park Kyungbae. 2016. "Open Innovation to Business Model: New Perspective to Connect Between Technology and Market." *Science, Technology and Society*, Vol.21 No.3: 324-348.

Yun, JinHyo Joseph, Won DongKyu, and Park Kyungbae. 2016. "Dynamics from Open Innovation to Evolutionary Change". *Journal of Open Innovation: Technology, Market, and Complexity*, Vol.2 No.2: 7.

Yun, JinHyo Joseph. 2015. "How Do We Conquer the Growth Limits of Capitalism? Schumpeterian Dynamics of Open Innovation". *Journal of Open Innovation: Technology, Market, and Complexity*, Vol.1 No.2: 17

Yun, JinHyo Joseph, Won DongKyu, Hwang ByungYong, Kang JinWon, and Kim DongHwan. 2015. "Analysing and Simulating the Effects of Open Innovation Policies: Application of the Results to Cambodia." *Science and Public Policy*, Vol.42 No.6: 743-760.

Prof Dr Yun's research interests include macro and micro dynamics of open innovation, mechanism design of business model, and political economics of open innovation.

Contributors

With honorable colleagues

The following 24 scholars are honorable colleagues of Prof Dr JinHyo Joseph Yun. They are co-authors of at least one of the 13 papers which are the sources of the 13 chapters of this book.

Andreas Pyka is a professor of innovation economics at Institute of Economics, Faculty of Economics, Business and Social sciences, University of Hohenheim in Stuttgart, Germany. He is the co-author of the standard work "Nelson, R. R., Dosi, G., Helfat, C. E., Pyka, A., Saviotti, P. P., Lee, K., ... & Malerba, F. (2018). Modern evolutionary economics: An overview." published in 2018 by Cambridge University Press. His research interests are the analysis of economic dynamics, change and transformation to provide insights into the required sustainability transformation.

ChangHwan Lee is a principal researcher at Korea Institute of Science and Technology Information (KISTI), South Korea. His representative research is applied mechanics. His research interests are Future Science & Technology analysis using AI.

DongKyu Won is the Director of Center for R&D Investment and Strategy Research, KISTI, South Korea. His representative research is "Lim, J. Y., Yoo, S. H., & Won, D. (2016). A Human-Needs-Based Dynamics to Simulate Technology Policy and Its Effects on Both Business Success and Human Happiness. Sustainability, 8(12), 1225.". His research interests are Complex System, R&D Investment and Strategy, Agent-based Modeling, Quantum Game Strategy.

Dongwook Kim is a professor at Graduate School of Public Administration, Seoul National University, South Korea. His representative research is "Shin, S. Y., Kim, D., & Chun, S. (2021). Digital Divide in Advanced Smart City Innovations. Sustainability,

13(7), 4076.". His research interests are Digital Government and Smart City.

EuiSeob Jeong is a principal researcher at KISTI, South Korea. His representative research is "Yun, J. J., Jeong, E., Lee, Y., & Kim, K. (2018). The effect of open innovation on technology value and technology transfer: A comparative analysis of the automotive, robotics, and aviation industries of Korea. Sustainability, 10(7), 2459.". His research interest is Data Mining.

Fumio Kodama is an emeritus professor at University of Tokyo, Japan. He is the main co-author of the book "Kodama, F. (2019). *Demand Articulation of Emerging Technologies: Investigating the Longitudinal Dynamics of Innovation*. Cambridge Scholars Publishing." He is also the main author of the book "Kodama, F., & Branscomb, L. M. (1995). *Emerging patterns of innovation: sources of Japan's technological edge* (Vol. 8, pp. 147-184). Boston: Harvard Business School Press. His research interests are Innovation Process, Management of Technology, Science Policy.

Giovanni Schiuma is a full professor at LUM University, Italy. His representative research is the book "Schiuma, G. (2011). *The value of arts for business*. Cambridge University Press.". His research interests are Arts-driven Innovation, Knowledge Management for Value Creation, Organisation transformation and innovation management.

HangSik Park is the vice president of EulJi University, South Korea. His representative research is "Linkage trend analysis of the 4th industrial revolution and open innovation". His research interest is Bio Technology Open Innovation.

JeongHwan Jeon is a professor at Gyeongsang National University, South Korea. His representative research is "Suh, Y.Y. and Jeon, J.H. 2019. Monitoring pattern of open innovation using the patent-based brokerage analysis, Technological Forecasting and Social Change,

146, 595-605.". His research interests are Open Innovation, Technology Monitoring, Bibliometric Analysis.

Jinxi Wu is a professor at School of Social Science, Tsinghua University, China. His representative researchis "Innovation ecosystem, innovation policy". His research interests are Innovation Ecosystem, Catch-up Capability, Low-Carbon Economy.

John C. Yi is a professor at Saint Joseph University, USA. His representative research is "Rhee, E., & Yi, J. C. (2020). Physician's interest to meet the sales rep and sample need: Implication to pharmaceutical detailing and sampling efforts. International Journal of Healthcare Management, 1-9.". His research interests are Sales and Marketing Analytics, Resource Planning and Optimization, Predictive Modeling.

KwangHo Jung is the dean of Graduate School of Public Administration, Seoul National University, South Korea. His representative research is "Jung, K., Lee, S. H., & Workman, J. E. (2018). Exploring a relationship between creativity and public service motivation. *Knowledge Management Research & Practice*, *16*(3), 292-304.". His research interests are Policy Instruments, Open Innovation, and Natural Experiments.

KyungBae Park is a professor at Department of Business Administration, Sangji University, South Korea. His representative research is "Kim, B., & Park, K. (2006). Dynamics of industry consolidation and sustainable competitive strategy: Is birthright irrevocable? *Long Range Planning*, *39*(5), 543-566.". His research interests are System Dynamics, Innovation Strategy, Strategic Management.

KyungHun Kim is a researcher at Local Development Research Institute, South Korea. His representative research is "A research protection measure for emotional laborer". His research interest is Conflict of Interest.

Lei Shi is a professor at Watershed Carbon Neutral Institute, Nanchang University, China. His representative research is "Zeng, D. Z., Cheng, L., Shi, L., & Luetkenhorst, W. (2021). China's green transformation through eco-industrial parks. *World Development*, 140, 105249.". His research interests are Industrial ecology, Carbon neutral, Eco-innovation.

MinHwa Lee was the professor of The Korea Advanced Institute of Science and Technology (KAIST), South Korea. His was the founder of Samsung-Medicine. His research interests were Entrepreneurship, Venture Incubating, Start-ups.

Min-Ren Yan is a professor at **National Chengchi University**, Taiwan. His representative research is "Sustainable System Development with Strategic Innovation". His research interests are Strategic Innovation, Sustainability, Systems Leadership.

Sam Youl Lee is a professor at Yonsei University, South Korea. His representative research is "Lee, S. Y., Jae Moon, M., & Hahm, S. D. (2010). Dual faces of ministerial leadership in South Korea: Does political responsiveness or administrative responsibility enhance perceived ministerial performance? *Administration & Society*, 42(1_suppl), 77S-101S.". His research interests are Innovation Study, Ministerial Leadership, Policy Analysis & Evaluation.

Sung Deuk Hahm is a professor at Kyonggi University, South Korea. His representative research is "Hahm, S. D., Kamlet, M. S., & Mowery, D. C. (1996). The political economy of deficit spending in nine industrialized parliamentary democracies: The role of fiscal institutions. *Comparative political studies*, 29(1), 52-77. ". His research interests are Korean Presidency, Political Economy and Industrial Policy.

Tan Yigitcanlar is a professor at School of Architecture and Built Environment, Queensland Technological University, Australia. His

representative research is "Yigitcanlar, T., O'Connor, K., & Westerman, C. (2008). The making of knowledge cities: Melbourne's knowledge-based urban development experience. *Cities*, 25(2), 63-72.". His research interests are Smart Technologies, Communities, Cities and Urbanism; Knowledge-Based Development of Cities and Innovation Districts; Sustainable and Resilient Cities, Communities and Urban Ecosystems.

Woo Young Jung is a principal researcher at DGIST, South Korea. His representative research includes Technology transfers in AI technology; Autonomous Personal Golf Cart**.** His research interest is Autonomous Driving.

Xiaofei Zhao is a senior associate researcher at Daegu Gyeongbuk Institute of Science and Technology (DGIST), South Korea, and professor at Open Innovation Academy (OIA). Her representative research is "Yun, J. J., Won, D., Park, K., Jeong, E., & Zhao, X. (2019). The role of a business model in market growth: The difference between the converted industry and the emerging industry. *Technological Forecasting and Social Change*, *146*, 534-562.". Her research interests are Open Innovation Culture; Business Model, Organization, and Behavioral Strategy.

YoungKyu Lee is a representative patent attorney of Jisung International Patent Law Office, South Korea. His representative research is "Molecular Dynamics, Open Innovation". His research interests are Technology Transfer, Innovation Measure.

Zheng Liu is a Senior Lecturer in Strategic Management at Cardiff School of Management, Cardiff Metropolitan University, Wales, UK. Her research outcome includes more than 10 papers relating to open innovation and innovation policy published at *Sustainability*, *Journal of Open Innovation: Technology, Market and Complexity*, and *Science, Technology, and Society*. Her research interests are Open Innovation, Business Ecosystem, Triple Helix innovation, and Sustainability.

PREFACE

I had the opportunity to understand the meaning of open access journals from three sentences in Henry Chesbrough's book, as follows (Chesbrough 2003, 44-45, 192).

> *Today, there is an abundance of knowledge in virtually every field around you. The proliferation of public scientific databases and online journals and articles, combined with low-cost Internet access and high transmission rates, can give your access to a wealth of knowledge that was far more expensive and time-consuming to reach as recently as the early 1990s.* (Chesbrough 2003, 44)

> *In the world of the Internet, leading scholars from around the world contribute new papers to online archives, creating a global community of scholars.* (Chesbrough 2003, 45)

> *Open publication promotes the vigorous exchange of ideas and creates a powerful stimulus to apply the ideas before someone else applies them instead.* (Chesbrough 2003, 192)

In addition, the book *Understanding Knowledge as A Common from Theory to Practice* edited by Elinor Ostrom (2009 Nobel Economic Prize Winner) and Charlotte Hess made me accept the high value of knowledge and open access journals as common ground (Hess and Ostrom 2011). Eventually, I decided to publish my own open access journal, *Journal of Open Innovation; Technology, Market, and Complexity.* Since then, I have been publishing at least one paper in open access journals every year myself.

This book is a collection of 13 papers which were published at open access journals in the past three years by me as the first author, and corresponding author.. All the co-authors and me who own the paper copyright have agreed to publish this book, and joined as the

co-author of the book.

In this book, I tried to answer my own research question, "how do we conquer the growth limits of capitalism?", which I framed in opposed to the questions from Immanuel Wallestein and others, "does capitalism have a future?" (Wallerstein *et al.* 2013). Capitalism is a form or method of economic change which comes from new consumer goods, new production or transportation methods, new markets, and new forms of industrial organization created by capitalist enterprises (Schumpeter 1942). I tried to answer this question through macro and micro dynamics of open innovation, mechanism design of business model, and political economics of open innovation in several open access journals with colleagues around the world.

The theoretical roots of these topics lie in the new combination by Schumpeter, bounded rationality by Herbert Simon, macro and micro economic dynamics by Karl Marx, Keynes and Schumpeter, mechanism design by Vickrey, market design by Roth, and open innovation and open business model by Henry Chesbrough.

New combination appears discontinuously and promotes the phenomenon characterized by emerging development covering five areas: (1) introducing new goods, (2) introducing new methods of production, (3) opening new market, (4) conquering new sources of supply of raw materials or semi-manufactured products, and (5) establishing new organizations of any industries, like creating a monopoly position (Schumpeter 1934). The new combination is the engine of open innovation dynamics and business model innovation.

Bounded rationality comes from risk and uncertainty, incomplete information about alternatives or the limitation in computation power, which makes us move from optimal rational choice to strategic choice to meet the requirements of Chess procedures (Simon 1972). Inter-rationality is a kind of bounded rationality in the open innovation dynamics which triggers the process of creative thinking as a heuristic (Newell *et al*. 1962, Simon 1979). During the digital transformation, the possibility of inter-rationality consisting of bounded rationality and creativity has

increased through new combination (Simon 1972, Newell *et al.* 1962, Simon 1979). This is the requirement of increasing the mechanism designs for diverse public economics and market design or business model design that can match between technology and market (Vickery and Arnott 1994, Roth 2015, Chesbrough 2006). Methods to conquer bounded rationality beyond inter-rationality include market design, mechanism design, or open business model in addition to open innovation (Chesbrough 2003). It means that valuable ideas can come from inside or outside the company, and can enter the market from inside or outside the company as well (Chesbrough 2003).

Macro dynamics of open innovation can stimulate the dynamic cycling among: 1) social open innovation with socialism and democracy, 2) SMEs or start-ups' open innovation with new combination of entrepreneurs, and 3) closed open innovation through the civilization of capitalism by large enterprises in the context that the income redistribution is likely to raise the propensity to consume, which may benefit the growth of capital (Keynes 1936). Macro dynamics of open innovation will be the way to escape the trajectory of Marx's capital accumulation or Schumpeter's growth hostility and decomposition (Marx 1906).

Micro dynamics of open innovation is a cycling process among open innovation, complex adaptive situation, and evolutionary and creative change. Through this, individual firms have the opportunity to innovate existing business models or invite new business models.

Last but not least, the rectangular compass on the book cover, inspired by Kazimir Malevich's painting, indicates two different meanings. First, macro and micro dynamics of open innovation demonstrate four rectangle aspects, political, economic, sociocultural, and environmental aspects, which can provide energy to conquer the growth limits of capitalism. Second, the four rectangle aspects of business model innovation, namely overshooting, bottom expanding, cultivating forward neighborhood, and cultivating backward neighborhood with open innovation dynamics, can motivate firms to continuously innovate existing business models.

Chapters in this book are revisions and rewritings of the works previous published in gold open access journals with co-uathors. The copyright of these works belongs to me and the co-authors, because JinHyo Joseph Yun wrote all these papers as the first and corresponding author together with several co-authors.

In Part 1, open innovation dynamics, we analyze diverse aspects of open innovation dynamics, ranging from open innovation culture, the impact of open innovation on technology value and technology transfer, the open innovation of James Watt, and Steve Jobs, to the effects of collective intelligence to open innovation, and the impact of distance on open innovation.

Chapter 1 generates insights into the role of "culture for open innovation dynamics". First, because the requirement to understand culture, which can control open innovation complexity, has been augmented, we want to answer the following research question in this study: *How can we define or organize "culture for open innovation dynamics", which can motivate open innovation dynamics, and control open innovation complexity?* Second, we build a concept model of culture for open innovation dynamics by reviewing the literature on the culture of firms in terms of their traits, organization, static innovation, and dynamic aspects regarding their innovation in entrepreneurship, and we validated this model through an indirect social experiment. Third, the concept model of culture for open innovation dynamics is explained as the interaction between three different entrepreneurship dimensions: entrepreneurship of novice entrepreneurs, intrapreneurship of employees of an existing firm, and organizational entrepreneurship by the firm itself. According to the balance of three sub-entrepreneurship types, culture for open innovation dynamics can have different aspects. This chapter helps organizations and entrepreneurs to better understand the role that culture plays in boosting open innovation dynamics. This chapter is from the publication of Yun, JinHyo Joseph, Xiaofei Zhao, KwangHo Jung, and Yigitcanlar Tan. 2020. "The Culture for Open Innovation Dynamics." *Sustainability*, Vol.12 No.12: 5076.

Chapter 2 analyzes the different results caused by open innovation in three Korean industries, automotive industry, aerospace industry, and robotics industry. With the advent of the Fourth Industrial Revolution, the Korean industrial environment has been rapidly changing. As a result, several industries are facing different innovation conditions, including: the automotive industry, which is a traditional manufacturing industry in Korea; the aerospace industry, which has been vertically integrated, and has been led by a single large company—Korea Aerospace Industries—since Korea went through an economic crisis in the 1990s; and the robotics industry, which is currently emerging. According to our analysis, first, the three industries experienced different effects of open innovation. Second, when large companies control a given industry, open innovation either worked a little or did not work at all. According to this research result, the Korean robotics industry, which has a weak dominance of large companies, experienced a strong effect of open innovation, in that joint patent applications led to economic gains from the patents and an increase in technology transfer and technology value. The aerospace industry of Korea, which has the highest dominance of large companies, experienced a slight effect of open innovation, as the effect of joint patent application only improved the technology value. Finally, the automotive industry of Korea had an intermediate level of open innovation, between the aerospace and robotics sectors. This chapter is from the following publication, Yun, Jinhyo Joseph, EuiSeob Jeong, YoungKyu Lee, and KyungHun Kim. 2018. "The Effect of Open Innovation on Technology Value and Technology Transfer: A Comparative Analysis of the Automotive, Robotics, and Aviation Industries of Korea." *Sustainability*, Vol.10 No.7: 245.

Chapter 3 analyzes the similarities and differences of open innovation between James Watt and Steve Jobs, the symbolic entrepreneurs in the first and fourth Industrial Revolutions. First, we pointed out the characteristics of the 1st and 4th Industrial Revolutions by comprehensively reviewing related and target books. Second, it analyzes related preceding research in addition to

reviewing books that describe open innovation characteristics that James Watt and Steve Jobs possessed. Third, it studies the open innovation strategies which were promoted by two through analyzing related preceding research and reviewing related books. Lastly, it shows the common and different points of their open innovation strategies based on the target book review result and the investigation result of all related preceding research. From this chapter, we could understand the dynamic change of open innovation between 1st Industrial Revolution, and 4th Industrial Revolution. This chapter is based onthe paper, Yun, JinHyo Joseph, KwangHyo Jung, and Yigitcanlar Tan. 2018. "Open Innovation of James Watt and Steve Jobs: Insights for Sustainability of Economic Growth." *Sustainability*, Vol.10 No.5: 1553.

Chapter 4 examines the relationship between collective intelligence and open innovation. Collective intelligence or crowd innovation not only produces creative ideas or inventions, but also moderates any firm to innovate inside-out, outside-in, or in a coupled manner. We asked the following research questions; *Does collective intelligence (or crowd innovation) motivate open innovation? Is there any difference in the effect of collective intelligence on open innovation by industry?* These research questions led to the following three hypotheses: (1) Collective intelligence increases the performance of a firm, (2) collective intelligence will moderate the effect of open innovation, and (3) differences exist between the automotive industry and the pharmaceutical industry in these two effects. To empirically examine these three hypotheses, we analyzed the registered patents of these two industries from 2000 to 2014 over a 15-year period. These automotive and pharmaceutical patents were registered in the B60 category and the A61K category of the Korea Patent office, respectively. Collective intelligence was measured by co-invention. We found differences in the effects of collective intelligence on open innovation between the two industries. In the automotive industry, collective intelligence not only directly increased the performance, but also indirectly moderated the open innovation effect. However, this was not the case for the

pharmaceutical industry. This chapter is from the publication of Yun, JinHyo Joseph, EuiSeob Jeong, Xiaofei Zhao, Sung Deuk Hahm, and KyungHun Kim. 2019. "Collective Intelligence: An Emerging World in Open Innovation." *Sustainability*, Vol.11 No.16: 4495.

Chapter 5 examines the effects of distance between technology and the market on open innovation. For this, we set up two research questions, as follows; *Is there any relation between the distance between technology and the market, and open innovation? If there is, what differences are there in the relation among Fortune 500 companies, non-Fortune 500 companies, laboratories, universities, and start-ups?* First, this study measured the distance between technology and the market of a patent by the size of its list of references and citations. Second, the OI network among patent application subjects was described based on patent similarity. Third and most importantly, regression analyses were used to answer the research questions. The first result was that there were differences in the distance and OI among Fortune 500 firms, Fortune non-500 firms, laboratories, universities, and start-ups. Thus, there are relations between the distance between technology and the market, and open innovation. The second result was that the distance between technology and the market was found to moderate the open innovation effect in Fortune 500 companies and laboratories. This chapter is from the follows journal paper, Yun, J. J., Jeong, E., Lee, C., Park, J., & Zhao, X. (2017). Yun, JinHyo Joseph, EuiSeob Jeong, ChangHwan Lee, JinSeu Park, and Xiaofei Zhao. 2017. "Effect of Distance on Open Innovation: Differences Among Institutions According to Patent Citation and Reference." Sustainability, Vol.9 No.8: 1478.

In Part 2, open innovation to business model, we examine the trajectory from open innovation to business model from the following aspects: business model innovation through a rectangular compass; sustainability condition of open innovation; open innovation and serial entrepreneurs; benefits and costs of closed innovation strategy; and business model, open innovation, and sustainability in car sharing. This part demonstrates open innovation

as business model in various ways.

Chapter 6 applies the open innovation concept to the design of creative business models, and develops an innovative way to alter existing business models to conquer the growth limits of exponential paradox. Our research question is as follows: *How can we innovate existing business models more easily based on our own thinking experiment at the role-place of ourselves in the open innovation knowledge funnel?* We built a rectangular compass concept model and carried out social experiments with it for 3.6 years from November 2014 to May 2019 by developing 17 business model patents to validate the model. The rectangular compass concept model has four aspects: over-shooting of modern business models, expanding the bottom of modern business models, cultivating the forward neighborhood of modern business models, and cultivating the backward neighborhood of modern business model. According to our study, open innovation, which is based on a new combination between technologies (protected technology, protectable technology, and social technology) and market (now market, potential market, and social market), is the engine of sustainable business model innovation dynamics. This chapter is from the following paper, Yun, Jinhyo Joseph, and Xiaofei Zhao. 2020. "Business Model Innovation through a Rectangular Compass: From the Perspective of Open Innovation with Mechanism Design." *Journal of Open Innovation: Technology, Market, and Complexity*, Vol.6 No.4: 1-20.

Chapter 7 answers the following question, "*does open innovation and the open business model exaggerate complexity (a transaction cost) in addition to the realization of emergence and its lock-in?".* Within a short period, Alibaba has become one of the global top e-commerce companies with several open innovation business models. How could Alibaba become a global top e-commerce company in China in such a short time? We chose a deep interview method, participatory observation, and meta-analysis to answer this question. Alibaba has applied global, creative e-commerce business models through open innovation in a short time. In addition, it has overcome complexity—i.e., the cost of open innovation and the force that breaks down a

company—through an open innovation-friendly culture. This is a "Jack-Ma style consumer confidence and new Guanxi culture", a new and strong Chinese corporate culture. Alibaba has also undergone the expansion of its open business model feedback loop platform. This chapter investigated the expanded open business model feedback loop platform, the continuously strengthened open-innovation-friendly culture, and complexity, with the latter being the cost of open innovation, which was controlled by an open-innovation-friendly culture and open business model feedback loop. This chapter is based on the following, Yun, Jinhyo Joseph, Xiaofei Zhao, Kyung Bae Park, and Lei Shi. 2020. "Sustainability Condition of Open Innovation: Dynamic Growth of Alibaba from SME to Large Enterprise." *Sustainability*, Vol.12 No.11: 4379.

Chapter 8 answers the research question, *"how does the serial entrepreneur in open innovation conditions continuously identify business opportunities?"*. With the advent of the 4th Industrial Revolution, the role of entrepreneurs has become more crucial than ever. As a result, an open innovation model is suggested here that can promote serial entrepreneurs. The question is answered through an in-depth case study of Medison from 1985 to 2016, as Medison is not only a representative Korean medical device company, but is also a representative example of serial entrepreneurship in Korea. First, we examined the diverse open innovation channels, such as spin-offs, venture investment, and joint venture, used by Medison before it was merged with Samsung. Second, we examined the open innovation serial entrepreneurs of Medison and then analyzed the direct serial entrepreneurs of Medison. Fourth, we built a causal loop model of Medison open innovation with emergence and complexity combined. Finally, a sustainable open innovation strategy and an approach to sustainable serial entrepreneurship was formulated. The findings from this chapter is first, an open innovation strategy can be a strong motivator for serial entrepreneurs. Second, a balance between emergence and complexity is required to trigger sustainable serial entrepreneurs of open innovation. This chapter is from the following paper, Yun, Jinhyo Joseph, MinHwa Lee, KyungBae Park,

and Xiaofei Zhao. 2019. "Open Innovation and Serial Entrepreneurs." *Sustainability*, Vol.11 No.18: 5055.

Chapter 9 answers the questions, "*did the closed innovation of Samsung trigger the Galaxy Note 7 withdrawal? If so What are the costs and benefits of Samsung's closed innovation?"*. The Samsung Galaxy Note 7 has been withdrawn from the market after a number of the devices exploded after its launch in 2016. From among the qualitative inquiry methods, this study used case study research, arrived at three important implications. The first is the benefit and cost of Samsung Electronics' closed innovation strategy. The second is the internal impact of the Galaxy Note 7 explosions on Samsung Electronics. The third is that success in open innovation strategies requires a great investment to produce strong effects. This chapter is based on the paper, Yun, Jinhyo Joseph, JeongHwan Jeon, KyungBae Park, and Xiaofei Zhao. 2018. "Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal." *Journal of Open Innovation: Technology, Market, and Complexity*, Vol.4 No.3: 20.

Chapter 10 discusses the dynamics and differences of business models in the car-sharing industry, focusing on open innovation as a trigger for diverse business models among Uber in the U.S., DiDi Chuxing in China, and KakaoT in Korea. We answered the following two questions: *What creates the differences in the business models of the car-sharing industry? Do the differences in open innovation motivate the diversity of business models among Uber, DiDi Chuxing, and KakaoT?* We incorporated participatory observation, interviews, and semi-structured questionnaire methods in our study. We used two-step participatory observation and interview methods, hence carrying out observation and interviews two times by different researchers with Uber drivers in the U.S., DiDi-Chuxing drivers in Beijing, and KakaoT taxi drivers in Korea to confirm the interview and participatory observation results. First, business models of the car-sharing firms Uber, DiDi-Chuxing, and KakaoT are not fixed but rather are dynamically changing. Second, business models of car-sharing firms are the result of interaction with government

regulations, the taxi industry, public transportation, and the automotive car industry. Third, open innovation strategies of car-sharing firms determine the contents and dynamics of car-sharing business models, such as the revenue business model, responsibility business model, and system business model upon interaction with four agencies. This chapter is from the following publication, Yun, Jin Hyo Joseph, Xiaofei Zhao, Jinxi Wu, John C. Yi, Kyung Bae Park, and Woo Young Jung. 2020. "Business Model, Open Innovation, and Sustainability in Car Sharing Industry-Comparing Three Economies." Sustainability, Vol.12 No.6: 1883.

In Part 3, political economics of open innovation, we investigate several aspects of political economics of open innovation, such as micro- and macro- dynamics of open innovation, basic income with high open innovation dynamics, and the ways to respond to the 4th Industrial Revolution or the 2nd IT revolution.

Chapter 11 explores how sustainability can be achieved through open innovation in the current 4th Industrial Revolution. Through a literature and practice review, we identify micro- and macro-dynamics of open innovation in addition to the dynamic roles of industry, government, university, and society. In particular, the industry continuously adopts open platforms to create and maintain ecosystem innovation. The government's role has changed from regulation control toward facilitation. Universities have become proactively engaged in multiple areas, from technology transfer to knowledge co-creation. Societies and customers have started to form new concepts, R&D, and commercialization, resulting in a shared economy. Based on the analysis, we proposed a conceptual framework to understand open innovation micro- and macro-dynamics with a quadruple-helix model for social, environmental, economic, cultural, policy, and knowledge sustainability. This chapter is from the following paper. Yun, JinHyo Joseph, and Zheng Liu. 2019. "Micro- and Macro-Dynamics of Open Innovation with a Quadruple-Helix Model." *Sustainability*, Vol.11 No.12: 3301.