

Graduate School of International
Culture and Communication Studies
Examination Report on the Doctoral Dissertation

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Dissertation Title · Subtitle : (English)	Organizing Open Innovation in Distributed Network
	A Socioeconomic Analysis of the Networked Production Models
Dissertation Title · Subtitle : (Japanese)	分散型オープン・イノベーション・ネットワークの組織論
	ネットワーク型生産モデルの経済社会学的分析

*Even if the dissertation is written in English, a Japanese language translation of the title and subtitle must also be submitted.

2022/01/20

YYYY/MM/DD

To Dean of Graduate School of International
Culture and Communication Studies,

Examination Committee

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The Examination Committee members report the results of the dissertation examination and the oral defense below.

1. Degree: Doctor of Philosophy (in International Culture and Communication Studies)

2. Curriculum Doctorate (*Katei Hakase*)

*Please delete either one.

3. Examination period

Dissertation examination: From 2021/10/11 To 2022/01/06
YYYY/MM/DD YYYY/MM/DD

Oral defense: 2022/01/07
YYYY/MM/DD

4. The results of the dissertation examination and the oral defense

*Please write down Pass or Fail in both categories.

Dissertation examination: **Pass**

Oral defense: **Pass**

5. Summary of the Dissertation

As per attached sheet

6. Table of Contents

As per attached sheet

7. The results of the dissertation examination and the oral defense

(About 3,000 characters in Japanese or 1,000 words in English)

(1) Evaluation and summary of the dissertation examination

(Including Summary of the Dissertation)

As per attached sheet

(2) Summary of the oral defense (including Comments and Questions)

The attached sheet of Questions and Answers shows that each examiner asked many questions and gave meaningful comments on the dissertation in the Oral Defense. Especially we asked questions on some theoretical and practical research points we could not understand easily and proposed him to revise the dissertation a little bit. Mr. Huang answered each question with logical consistency and accepted our proposal to revise the dissertation.

See the attached sheet of Questions and answers(7.(2)).

5. Summary of the Dissertation

This research focuses on the implementations of open innovation in the business networks of a globalized economy. This research provides an extensive understanding of the open innovation process management in the business context. This research also proposes the determining factors, constraining factors, and managerial mechanisms of open innovation in various innovation types and network configurations.

This dissertation is composed of three parts: 1) Chapter 1 and Chapter 2, the introduction and the background of open innovation; 2) Chapter 3, the literature review on the previous theoretical implications and empirical studies of the open innovation paradigm; 3) Chapter 4 to Chapter 5, the empirical research on the implementations of open innovation in different industrial sectors. After the three parts, Chapter 6 concludes this research and discusses the impact and implications of the open innovation paradigm.

Open innovation is a paradigm that promotes innovation from purposive utilizing and combining the internal and external ideas, knowledge, and resources. Open innovation is a distributed extension of the Schumpeterian innovation theory. Open innovation helps manage the product innovation, the process innovation, the market innovation, the input innovation, and the managerial innovation by allowing combinations of inbound, outbound, and coupled innovation processes across the boundary of an innovation organization.

Open innovation has become more and more influential in the emergence of a globalized economy. Both the digital production and the physical manufacturing are becoming more and more diverse and complicated. Companies and individuals have to collaborate agilely and flexibly to survive the rapid-changing networked era. However, the study of open innovation is in its preliminary stage. Although open innovation has already been widely accepted as a helpful solution to manage the collective productions, the current

theoretical and empirical frameworks in economics and management science are still unable to understand the mechanism of open innovation. Notably, we need to find an applicable managerial mechanism for the distributed open innovation in the business networks.

To solve the academic and practical issues, this research starts from a review of the Schumpeterian innovation theory. With the insights from Schumpeter's theories, this research further investigates the new institutional school for a consistent and unified managerial methodology on the issues of innovation management.

This research then analyzes the previous literature on open innovation. By comparing the different theoretical development, determining and constraining factors, practical experiences, empirical implementations, and managerial implications, this research has concluded and summarized the previous research in different levels of analysis.

After combining the theories, analytical tools, and methodologies from the Austrian school of economics, the new institutional school, and the management sciences, this research presents a comprehensive analytical framework with four axes: the open innovation processes, the innovation types, the organizational factors, and the network configurations. This framework can assign the most findings of the existing literature. This research then applies the game theory to provide a theoretical background of the analytical framework. As the game theoretical models suggest, the analytical framework of this research is able to analyze the business implementations of open innovation. We will apply the framework to the comparative case studies of this research.

In the empirical research part, this dissertation comparatively analyzes seven commercial companies representing different types of productions and implementing different open innovation approaches. By comparing the successful cases with the failed cases, this research has identified the conditions, path dependencies, and the necessary and sufficient factors to implement open innovation in different innovation types and different

production networks. The empirical case studies have proven that open innovation is an effective solution to deal with cooperation and coordination issues in the distributed business network. Particularly, the empirical research has suggested that the capital-intensive and the labor-intensive firms, being ignored by the previous research, can also benefit from open innovation implementations if organized and managed properly.

In the last chapter, this research discusses the impact and implications of the open innovation paradigm. This research suggests the open innovation paradigm can be applied to more business, organizational, and governance sceneries.

Keywords: Open innovation, distributed network, innovation management, innovation network

6 . Table of Contents

Chapter 1	The Emergence of a Globalized Open Economy	1
1.1	The Motivation	1
1.2	The Objectives	5
1.3	The Structure of this Research	8
Chapter 2	Innovation and Management: The Background	12
2.1	Innovation: The Key Factor of Modern Economic Development	12
2.2	Innovating “Innovation”: The Route to the Open Innovation	16
2.3	The Headstream of Open Innovation: Open Source Model in Software Industry	22
2.4	Production Management: New Institutional Economics Approaches	26
2.4.1	The Property Rights Theory	28
2.5	Innovation Management Theories	33
2.5.1	Typology of Innovation: The Henderson-Clark Model	33
2.5.2	“Networked” Innovation Management: Innovation Process Management	35
2.5.3	“Cross-network” Innovation Management: Innovation Intermediary	39
2.6	Conclusion: The History of Innovation and its Management	42
Chapter 3	Literature Review: Open Innovation and Its Implementations	45
3.1	The Open Innovation Theory	45
3.1.1	Different Typologies of Open Innovation	47
3.1.2	Open Innovation in Networked Production	51
3.1.3	Benefits and Challenges of Open Innovation: Management is Critical	56
3.2	Previous Theoretical Implications: Commons-based Peer Production	59
3.2.1	Peer Production in Open Source Software Development	66

3.3	Previous Empirical Studies: Applications of Open Innovation	73
3.3.1	Open Innovation in ICT Industry	73
3.3.2	Open Innovation Outside ICT	77
3.4	Distinguish Open Innovation and Other Similar Concepts	84
3.5	Conclusion of Literature Review	90
Chapter 4 Research Design 96		
4.1	Definition of Open Innovation in this Research	96
4.2	Research Questions	98
4.3	Game Theoretical Buildings of the Open Innovation in Distributed Network	100
4.3.1	Basic Concepts: The Elements and Nash Equilibrium of a Game	101
4.3.2	Types of Games and the Solutions	103
4.3.3	Networked Open Innovation Games in Normal Form	107
4.3.3.1	Game Settings	109
	Game 1.1: Radical Innovation Game	112
	Game 1.2: Architectural Innovation Game	114
	Game 1.3: Modular Innovation Game	116
	Game 1.4: Incremental Innovation Game	117
4.3.3.2	Conclusion: Open Innovation Typology	119
4.3.4	Lumpy Signaling Open Innovation Game	122
4.3.4.1	Hybrid Sequential Game Setting	123
	Game 2: Lumpy Signaling Game	124
4.3.4.2	Conclusion: Mechanism for the Diffusion of Open Innovation	127
4.3.5	Expansion of the Open Innovation Games	127
4.4	Research Design: Methodology for the Empirical Case Studies	130

4.5	Conclusion of the Research Design	131
Chapter 5 Implementations of Open Innovation in Distributed Network 134		
5.1	The Objectives of the Empirical Case Studies	134
5.2	Case Studies: Business Implementations of Open Innovation	135
5.2.1	Case A: Borche Machinery Co., Ltd.	138
5.2.2	Case B: Ewatt Technology Co., Ltd.	153
5.2.3	Case C: Shenzhen Han's Robot Co., Inc.	164
5.2.4	Case D: Hubei Prolog Technology Co., Ltd.	178
5.2.5	Case E: Hubei Xiangyuan New Material Technology Inc.	187
5.2.6	Case F: Wuhan Yuanqi Technology Co., Ltd.	194
5.2.7	Case G: Hanbroad Business Management Group Co., Ltd.	200
5.3	Conclusion: Business Implications of Open Innovation	208
5.3.1	Commercial Implementations of Open Innovation Paradigm	208
5.3.2	Applicability of Open Innovation in Henderson-Clark model	211
5.3.3	Trust in the Distributed Open Innovation Management	212
5.3.4	Adopting the Appropriate Open Innovation Managerial Mechanism	214
Chapter 6 Conclusion and Discussion 217		
6.1	Summary of the Research	217
6.2	Key Insights	222
6.3	Limitations and Remaining Problems	227
References		230

List of Tables

Table 1. The history of open source software	24
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Table 2. Allocation of property rights in different types of firms	30
Table 3. The structure of property rights assignment in an organization	31
Table 4. Typology of intermediation in the innovation process	41
Table 5. Comparison of different definitions of open innovation	47
Table 6. Dahlander and Gann (2010)'s typology of open innovation	49
Table 7. Different understandings of critical aspects concerning innovation	54
Table 8. Principles, potential benefits, and the challenges of open innovation	56
Table 9. The merits and demerits of open innovation	58
Table 10. Advantages and disadvantages of open innovation adoption in the system integrating business	74
Table 11. Classification of open innovation and open business models.	80
Table 12. Levels of analysis of previous open innovation researches	91
Table 13. Previous researches categorized from the level of analysis	92
Table 14. The open innovation perspectives in this research	98
Table 15. The analytical framework of open innovation in this research	99
Table 16. The analytical framework of open innovation implementations in the case study	132
Table 17. The analytical framework of open innovation factors in the case study	132
Table 18. Overview of the cases	137
Table 19. The commerce registration information of Borche Machinery Co., Ltd.	139
Table 20. Borche Machinery Co., Ltd.'s assets and liabilities	141
Table 21. The costs of Borche Machinery Co., Ltd.'s production	142
Table 22. The revenues of Borche Machinery Co., Ltd.'s products (services)	143
Table 23. The gross profit ratios of Borche Machinery Co., Ltd.'s products (services)	

	144
Table 24. Interviews conducted for case study A (Borche Machinery Co., Ltd.)	145
Table 25. Financial performance of Borche Machinery Co., Ltd. during the research period	149
Table 26. Comparison of the plastic molding equipment manufacturers	151
Table 27. Borche Machinery Co., Ltd.'s open innovation approaches and results	152
Table 28. The commerce registration information of Ewatt Technology Co., Ltd.	154
Table 29. Ewatt Technology Co., Ltd.'s assets and liabilities	156
Table 30. The financial analyses of Ewatt Technology Co., Ltd. in FY2015 and FY2014	157
Table 31. The revenues and gross profit ratios of Ewatt Technology Co., Ltd.'s products	157
Table 32. Interviews conducted for case study B	159
Table 33. Ewatt Technology Co., Ltd.'s open innovation approaches and results	163
Table 34. The commerce registration information of C	164
Table 35. Comparison of the financial performances of companies in the robotic manufacturing industry in fiscal year 2020	166
Table 36. The sales data of Han's Robot Co., Inc. in 1H2021	167
Table 37. Interviews conducted for case study C	169
Table 38. Han's Robot Co., Inc.'s open innovation approaches and results	177
Table 39. The commerce registration information of Prolog Technology Co., Ltd.	178
Table 40. The personnel composition of Prolog Technology Co., Ltd. in 2018	179
Table 41. Interviews conducted for case study D	181

Table 42. Prolog Technology Co., Ltd.'s open innovation approaches and results	
	183
Table 43. The commerce registration information of Xiangyuan New Material Technology Inc.	187
Table 44. Interviews conducted for case study E	188
Table 45. Xiangyuan New Material Technology Inc.'s open innovation approaches and results	190
Table 46. The commerce registration information of Yuanqi Technology Co., Ltd.	194
Table 47. Interviews conducted for case study F	195
Table 48. Yuanqi Technology Co., Ltd.'s open innovation approaches and results	196
Table 49. The commerce registration information of Hanbroad Business Management Group Co., Ltd.	200
Table 50. Interviews conducted for case study G	201
Table 51. Hanbroad Business Management Group Co., Ltd.'s open innovation approaches and results	201
Table 52. Overview of the open innovation approaches in the empirical research	209
Table 53. Open innovation approaches found in the case studies.	210
Table 54. Factors discussed in empirical research	211
Table 55. The innovation types of cases in Henderson-Clark model	212
Table 56. The beneficial and constraining factors of open innovation	222

List of Figures

Figure 1. Before and after the digitalization	1
Figure 2. Five types of Schumpeterian innovation	14
Figure 3. A closed innovation model	19
Figure 4. An open innovation paradigm	19
Figure 5. Henderson-Clark model of innovation typology	34
Figure 6. The innovation process model	37
Figure 7. The open innovation model	46
Figure 8. The outside-in, inside-out, and coupled processes of open innovation	49
Figure 9. Open innovation 2.0: A new milieu	50
Figure 10. Typology of innovation intermediaries	53
Figure 11. The explosion of combinations	56
Figure 12. Lumpy goods	62
Figure 13. The positions of different production types	63
Figure 14. The management of different innovation approaches	65
Figure 15. The networked workflow in the peer production model	66
Figure 16. Schema of distributed version control system	72
Figure 17. The promoter network	78
Figure 18. SECI model: the four modes of knowledge creation	85
Figure 19. Schema of the in-house innovation	88
Figure 20. Schema of innovation in a platform economy	88
Figure 21. Schema of innovation in an open innovation ecosystem	89
Figure 22. Two-player normal form game payoff matrix	103
Figure 23. Prisoner's dilemma	104
Figure 24. Two-stage extensive form game decision tree	106

Figure 25. Henderson-Clark model in the open innovation games	109
Figure 26. Payoff matrix of the open innovation games (Game 1.1-1.4)	110
Figure 27. Payoff matrix of the architectural innovation game	115
Figure 28. Payoff matrix of the modular innovation game	117
Figure 29. Result of the open innovation games	120
Figure 30. Game 2: Lumpy signaling game	125
Figure 31. The architecture of iPlasCloud of Borche Machinery Co., Ltd.	146
Figure 32. The comparison of specs between Han's Robot Co., Inc.'s product (in red box) and its competitors	172
Figure 33. The market scales of collaborative robots and industrial robots	176
Figure 34. The applicability of open innovation in the Henderson-Clark model	223

7. (1) Evaluation and summary of the dissertation examination

イノベーションという概念は、世界大恐慌で明らかになったそれまでの資本主義の在り方への深刻な危機に対し、資本主義の存続に向けた新たな考え方として、J.A.シュンペーターによってその著書『経済発展論』のなかで提唱されたものである。彼は経済が発展していくためには各企業が新たな知識・技術を組み合わせること（New Combination=新基軸）によって①新しい生産物、②新しい市場、③新しい生産技術、④新たな生産原料、⑤新たな経営組織、などを創造することが必要と述べた。それは新たな技術の創造（技術革新）と同時に新たな社会価値の創造をも意味した。もしそれが実現されないならば、資本主義は変質し、社会主義（あるいは国家独占資本主義）になってしまうとした。その後このイノベーション論について、それが国民経済にどのような効果を与えるかについては、景気循環論や市場構造論の枠内において研究が進められる一方、どのような経営組織がイノベーションを容易に生み出しうるか、あるいはイノベーションが実現した結果得られる経済利益の所在についての問題などが経営学の枠内で様々な議論がなされてきている。これらの議論はすべて各自が内部組織内で行う自前主義（クローズドイノベーション）を前提としてきたのも事実であろう。

しかし、1980年代から90年代にかけて世界経済では資本主義が主流化し、各国経済はそのグローバル化を推進してきたが、その一方で特に90年代以降に先進国でICT（情報通信技術）革命が急伸した。その結果、世界では各市場のグローバル化による市場規模および経済ネットワークの拡大、それに伴う輸送技術・ネットワークの改善による輸送コストの大幅削減の実現、さらには知識・情報伝達の容易化・豊富化・国際化が生産・供給・需要に大きな変化を生み出した。すなわち、各経済で顧客ニーズの多様化、製品サイクルの短期化、世界経済レベルでの生産を含めた競争構造の変化などが発生し、それらへの対応としてのイノベーションはそれまでの自前主義では不可能あるいは非効率となってきた。そこで登場したのが“オープンイノベーション”である。これはそれまでの自前主義に対して外部の知識・アイデア・技術を内部のそれらと融合（New Combination=新基軸）させて新たな技術（技術革新）や社会価値を生み出そうとする（Creative Deconstruction=創造的破壊）ものである。これは特にコンピュータソフト開発に率先して活用されてきているが、そこには各々の利益が相対立しがちな自己利益追求の資本主義においては、それらが企業利益上成功しうるか否かについて疑念が生じうる。すなわち、それがどのような環境において成功し、さもなければ失敗するのかは大きな問題となろう。本博士論文はこの問題に挑戦している。

以下論文の内容である。まず、序章では今日のICT革命下における新たなデジタルコミュニケーション社会の到来において情報交流の豊富化・容易化が実現してきているが、そこでの経済学的意味が強調される。すなわち、知識・アイデアなどの情報創成・交換には初期費用はかなりつくものの、その追加費用である限界費用はほぼゼロとなる社会が到来し。要するに、ひとたび通信ネットワークが構築されたならば、すでに創造された知識・アイデアなどの情報財の通信交換費用はほぼゼロとなる。そこで、各企業にとっては、外部との容易な情報交換ネットワーク環境の中でのイノベーション創成、すなわちオープンイノベーションこそ各企業にとり今日のグロ

ーバル化された産業社会を生き抜いていく重要な手段となる。それをいかに実現していくか。また、その実現についてどのような環境が必要となるのか。筆者はこれらを本論文の主たる研究課題とすることをここで明らかにする。

次の第2, 3章では、その研究課題についての先行研究を整理している。まず、「イノベーション」の概念の提唱者である J.A.Schumpeter を取り上げ、イノベーションには5つの範疇があり、それらについて説明するとともに、それらはいくまで企業が主体的に内部の知識や研究によって実現されるものであることや各企業がそれを追求することで資本主義が存続しうるのと彼の主要成果を強調する。それを引き継ぎ経済学的展開として、そのイノベーションの経済変動効果、経済構造変化への効果、あるいは A.Brian による経路依存性に見るイノベーションの実現条件および内生的経済成長論などの研究成果に言及しつつ、イノベーションの内生性や経済構造や経済制度そのものへの大きな変化効果をもたしうることを文献を通じて紹介される。

その一方、経営学の面では各イノベーションの内容の分類・整理に努めた研究論文を取り上げているが、そのなかでも内外の知識・アイデアの組み合わせでイノベーションを4つに分類する Henderson-Clark Model やネットワークを有効活用したイノベーションの管理についての研究成果とともにデジタルネットワーク下でイノベーションがより容易になってきたことを強調する文献も紹介している。そこで、コンピュータソフト開発や半導体開発において創成されてきたイノベーションについて特に着目し、それまでのイノベーション自前主義が転換され、外部の研究開発成果を積極的に取り込んでイノベーションを創成してきている事実を文献を通じて、その事例を紹介している。そこで、そうした新規の動きをオープンイノベーションと定義し、その創成の在り方を詳述することで New Paradigm 実現させた H.Chesbrough の成果を取り上げ、今日の ICT コミュニケーション社会ではこのイノベーションが市場競争上優位となることを強調する。さらに、この章ではそれに伴って発生するさまざま財産権問題についても先行研究を活用して利害対立が生じないケースを多数紹介しており、起こりうる懸念の払拭に努めている。そこで残る問題として今日の ICT 社会においてオープンイノベーションはどのような要件で創成、成功しうるか。筆者はこの点を以下の章で解いていく。

第4章ではゲーム理論の逐次ゲームを用いて、Henderson-Clark Model の4種のイノベーションのオープンへの応用可能性を立証する一方、情報を集合財とみなし、その存在の下でシグナリングゲームを設定し、その解の存在を検証している。特にそこにおいてプレイヤー間に相互信頼が有るケース、無いケースに分類し、そこでの協調ナッシュ均衡解の存在を検討し、相互信頼がない場合でもナッシュ均衡解が存在するケースを導出している。こうしたゲーム理論的検証は筆者のオリジナルである。

第5章では筆者自身による実証研究の成果を展開する。筆者は中国異業種企業7社に対して、それぞれの経営責任者および研究開発担当者への直接ヒアリングおよびアンケート調査によって質的データを収集し、解析している。そして、業種に関係なく相互に信頼関係がなくても、一定のネットワークの中でオープンイノベーションが創成可能であることが立証されている。この成果は、前章のゲーム理論的アプローチ解の追認であるが、実証面でも業種を超えてオープンイノベーションが成立しうることを証明した点で重要であり、今日の産業社会におけるオープンイ

ノベーションの重要性と現実的正当性が確認されたのである。

最終章は結論部であり、オープンイノベーションが今日のデジタルコミュニケーション社会において、市場競争を勝ち抜いていくためにはオープンイノベーションが重要であり、それらは業種を超えて、相互に信頼関係がなくても各企業は協調しつつ、オープンイノベーションを成立させることが本論で展開され、結論としてそれを立証できた成果を強調している。

以上、黄浩君の論文の内容であるが、設定された課題に対して、独創的なゲーム理論的アプローチと企業への独自の直接ヒアリングおよびアンケート調査による質的データの解析を通じて一貫した論理展開のもとに納得しうる結論を導き出している。本研究成果はイノベーション研究分野に対し独自の学術的貢献をなしうるものと高く評価できる。

なお最終口頭試問における各委員からの質問については妥当な返答がなされたし、またそれぞれの委員会から指摘された論文本体の修正については適切に修正が行われた。

以上理由により、審査委員は黄浩君の提出した博士論文については全一致して合格の判定をした。

以上。

Questions and Answers in Oral Defense Examination

真野先生：

1. The thesis has provided a comprehensive understanding of the open innovation implementations in different innovation types. I would like to ask a question on the applicability of open innovation in modular innovation.

You have suggested that open innovation is not suitable for modular innovation. But your conclusion seems to be only based on the failure of case B (Ewatt Technology Co., Ltd.).

For example, SONY is trying to apply an open innovation approach in its EV (electronic vehicle) products. EV is a typical modular innovation that applies the new technology to an existing market. Do you think SONY will fail in its EV project?

(Open innovation による Modular innovation の可能性はケース B によって否定したが、実際、ソニーが EV をオープンで開発している。EV も典型的な Modular innovation なので、ソニーは失敗すると思うか。)

A: In our research, we suppose open innovation is not fit for modular innovation due to the following two reasons: 1) In the game theoretical model of modular innovation, a start-up cannot cooperate with its rivals if the new technology is straightforward (easy to understand and imitate) for the rivals. 2) In the case study of B (Ewatt Technology Co., Ltd.), the current market leader can use its market power to force the newcomer out of the existing market.

However, it is true that open innovation may succeed in a modular innovation situation. Your example of EV is a very typical case of modular innovation. Tesla, the biggest EV company now, is also using an open innovation strategy. Most of Tesla's core competences (components of EV) are joint-developed with a group of other companies: For instance, the batteries are joint-developed with Sanyo/Panasonic and LG, the controllers are joint-developed with Nvidia and AMD. Open innovation implementation of Tesla has given the company flexibility to succeed in the rapid changing market of EV.

Even in our case study B (Ewatt Technology Co., Ltd.), the early open R&D processes had achieved some positive results. B's failure dues more to its bad innovation process management and financing management. It is difficult to use B's failure to deny the possibility of open innovation in modular innovation.

Therefore, it is worth doing some further research on the applicability of open innovation in different modular innovation situations.

(本研究では、理論的な分析とケース・スタディの両方によって Open modular innovation を否定した。

ただし、Modular innovation である EV は確かに Open innovation によって成功可能である。EV 最大手のテスラもオープン R&D 戦略を採っている。更なる研究が必要である。)

2. You have summarized a lot of sufficient factors of open innovation. Do you have a ranking of these factors? The priorities of different factors should be important for the business.

(要因はたくさん挙げているが、それらのランク・重要性は明らかにしているか。)

A: Yes, it is very important to understand the priorities of different constraining factors in the business scene. However, our research methodology is based on small-N comparative case studies. The factors are summarized from different cases. This research method is not able to solve the ranking problem. **We would suggest this issue in the limitation and future research part of the thesis.**

(ご指摘通り、ビジネス上、要因のランクがとても重要である。ただし、本研究は少数事例の比較分析による探索的研究であるゆえ、要因は個々のケースからまとめられた。この研究方法では、異なる要因のランク・重要性は解明できない。これは本研究の限界であり、更なる研究が必要である。)

3. Generally speaking, there are several stages in the R&D of a technology.

For example, in the development of CPU (central processing units), the first or second stage that provides the key concept (architecture) of the CPU is often collaborated by different companies. However, the development of a specific CPU is often done by an individual company in a closed innovation manner.

Do you think open innovation is more suitable for the previous stages than the latter stages?

(技術開発には、段階がある。例えば CPU では、第 1・第 2 の開発段階ではオープン・イノベーションが一般的だが、専用 CPU の段階だとクローズドな個別開発になる。オープン・イノベーションは第 1・第 2 の段階だけに適するか。)

A: It is true that open innovation is more common in the previous stages of R&D. However, open innovation is also applicable in the latter stages.

Take the specific CPU as an example. The single functional processors such as MCU and ISP are often developed in a closed innovation manner. However, the modern specific CPUs (such as FPGA and SoC) are becoming too complex. An individual company often does not have all the capabilities to develop a FPGA or a SoC. Nowadays, the production of specific CPU is also done in a collaborative manner. The EDA providers, the IP providers, the design houses, and the semiconductor manufacturers have to cooperate together in order to develop and tape-out a specific CPU.

Therefore, open innovation is not only suitable for the previous stages, but also applicable for the latter stages of R&D. **I will add each case's R&D stage to the case studies.**

(確かにオープン・イノベーションがすでに第1・第2の開発段階に普及し広く応用されているが、それ以降の段階にも適用可能である。

CPUを開発・生産する半導体業界は、オープン・イノベーションにシフトしている。昔、専用CPU (MCU や ISP など) の開発はクローズド・イノベーションが主流であるが、現代の専用CPU はとても複雑で一企業では開発できない。今は EDA 開発者・IP 提供者・デザインハウス・デバイス製造業者などの協働によって専用 CPU を開発・生産している。

ご指摘した各ケースの開発段階については、ケース・スタディに加筆する。)

Shu 先生 :

1. Your research of open innovation is based on two assumptions: 1) Low marginal cost; 2) High fixed cost. In the economics, such situation will lead to a natural monopoly. How can the natural monopolistic market be open?

For example, TSMC and Samsung have monopolized the semiconductor manufacturing market. But you have mentioned that they are adopting the open innovation paradigm. Why do they want to apply the open innovation strategy?

(この研究は、低い限界費用と高い固定費用をオープン・イノベーションの前提としているが、経済学的にこういう場合は自然独占状態となる。自然独占の企業は、なぜオープン・イノベーションを受け入れるか。半導体産業の事例を持って説明してください。)

A: It is true that low marginal cost and high fixed cost would lead to natural monopoly in a local/regional-restricted market. However, the digital production, with zero marginal cost and high fixed cost, is a different story. Digital goods have to be produced and consumed in a global network, and thus cannot be restricted in a closed market.

The semiconductor manufacturing industry is a typical case of the global networked production. The semiconductor manufacturing is too complex that has to be a global production. Although TSMC and Samsung have occupied a majority of this market, they have to joint-develop lithographic devices with Dutch and Japanese companies (ASML, Nikon, etc.), have to purchase materials from Japanese and American companies, and have to outsourcing the assembly and test workflows to Chinese and Malay companies. The semiconductor manufacturing is not a regional-restricted market.

Furthermore, the customers have extensive needs in the semiconductor market. To fulfill the plural needs of the customers, open innovation becomes a common strategy in the semiconductor manufacturing industry. TSMC has been joint-research with Intel, SMIC, and other rivals for decades. Samsung is also collaborating with IBM, AMD, and many other companies in this industry. Therefore, the semiconductor manufacturing is not a natural oligopoly market.

To conclude, low marginal cost + high fixed cost + the complexity of a networked market =

open innovation.

(地域的かつ流動性のない市場では、確かに低い限界費用・高い固定費用の場合は自然独占になるのだが、デジタル市場は流動性豊かな国際市場でなければならない。デジタル生産も消費も、ネットワークが必要であるから。

開発・生産・需要が共に極めて複雑な半導体製造は、典型的な国際協力が必要な産業である。TSMC やサムソンが市場を支配しているが、日蘭米中の複数企業との協働によってようやく半導体製品の供給ができるし、複数 Fabless や Fab との共同開発によってようやく市場需要を満たすことができる。

低い限界費用+高い固定費用+複雑な市場ネットワークでは、オープン・イノベーションが適するであろう。)

2. You have also assumed the globalization in your research of a global distributed open innovation. However, recently there is a trend of deglobalization in the world. The decoupling of United States and China might affect the efficiency of the global supply chain.

How does this trend affect the implementations of open innovation? What can be a possible solution?

(グローバリゼーションも分散型オープン・イノベーション・ネットワークの前提の一つとしているが、最近では米中貿易戦争をはじめ、国々間のデカップリングを国際サプライチェーンに悪影響を与えている。

これはオープン・イノベーションの実現にも影響するか。対策はあるのか。)

A: The trade war, the COVID-19 pandemic, and other deglobalization factors have definitely affect the open innovation implementations negatively. We have found some negative results in our case studies. For instance, the case C (Shenzhen Han's Robot Co., Inc.): Due to the travel restrictions, C (Han's Robot Co., Inc.)'s open innovation implementations did not work as efficiently as expected in the mass-production of collaborative robots.

We have surveyed and discussed several potential solutions in the thesis. In Case E (Hubei Xiangyuan New Material Technology Inc.), we have found that the innovation intermediaries could be employed as the network-brokers in a trustless open innovation network. The Lumpiness of innovation is another promising mechanism to construct and stabilize a zero-trust open innovation network under some specific conditions.

(ディグローバリゼーションはオープン・イノベーションに悪影響を与えるであろう。渡航制限によりエンジニアの流動ができないがため、ケース C (Shenzhen Han's Robot Co., Inc.) の生産性が予期より低い結果となった。

論文には、解決策をいくつ挙げている。ケース E (Hubei Xiangyuan New Material Technology Inc.) にあるイノベーション仲介者は、ネットワーク・ブローカーとなってオープン・イノベーション・ネットワークの成立に貢献した。そのほか、Lumpiness も特定のオープン・イノベ

ション・ネットワークを安定化する仕組みである。)

吉見先生：

1. Could you explain the reasons of research question setting? Are the research questions related to your literature review?

(研究問題と先行文献の関係性を説明せよ。)

A: The research questions are based on the remaining problems of the previous research.

Research question 1 (RQ1) focuses on two individual-level factors that have not been deeply analyzed in the previous literatures: 1) the incentives of open innovation adoption other than productivity gains; 2) the coordination factors to adopt open innovation. The existing research papers have raised several possible factors concerning the trust and motives to adopt open innovation. However, only the productivity gain has been analyzed empirically.

Research question 2 (RQ2) focuses on the environmental variables and configurations of the open innovation networks. There is almost no empirical research on this issue outside the ICT industrial sector.

I will further clarify the relationships between my research questions and the remaining problems of the previous research.

(先行文献でまだ解決していない問題を中心に研究問題を設定した。)

RQ1 は、企業・個人がオープン・イノベーションに参加するための **Motives** と **Trust** を取り込んでいる。先行文献はこれらの重要性を強調しているが、生産性以外はほとんど研究されていない。

RQ2 は、ICT 産業でしか研究されていないオープン・イノベーション・ネットワークの成立条件を取り込んでいる。

最終稿では、研究問題と先行文献の関係性をもっときちんと説明するよう修正する。)

2. Your literature review has suggested that the ICT industry, particularly the software industry, have been extensively analyzed in the previous research. What is the originality of your Chapter 6, which analyzes only four software development projects?

(文献調査では、ソフトウェア業界がよく研究されていることをわかったのに、なぜ第6章でたったの4つのソフトウェアプロジェクトを分析するか。第6章の新規性について説明せよ。)

[Chapter 6 is deleted in the final revision.]

[最終稿で第6章を削除済み]

A: The research objects of Chapter 6 are the multimedia specific software development projects. This is a niche market with less than ten products. The four projects are all the open innovation cases in the niche sector of the software industry (at the time of research).

Besides, this type of open source software development is not covered by the previous

literatures. Furthermore, the multimedia specific software development is an implementation of an existing standard, which is much different from the other software development. This research has found different results with the previous research. These are the originalities of Chapter 6.

(第6章は、先行文献が研究されていないマルチメディア専用ソフトを対象としている。ニッチ市場につき、この4つのプロジェクトが全てのオープン・イノベーション事例を網羅している。さらに、マルチメディア専用ソフト開発は既存スタンダードの実装にとどまるため、普通のソフトウェア開発と異なる結論に至った。そこが第6章における新規性だと思う。)

3. The case studies of D (Hubei Prolog Technology Co., Ltd.) and E (Hubei Xiangyuan New Material Technology Inc.) are shorter and have less explanations than the other cases. What are the reasons?

(ケースDとEは他のケースより短い、その理由について説明せよ。)

A: Case D (Hubei Prolog Technology Co., Ltd.) and E (Hubei Xiangyuan New Material Technology Inc.) are adopting traditional innovation management approaches in the open innovation implementations. As the results, their open innovation networks are smaller than the other cases. We did not explain the traditional innovation management approaches in detail in the current revision due to they are not related to the theme of open innovation in distributed network. However, as Prof. Yoshimi pointed out, we should explain them in detail. **We will revise these parts in the final revision.**

(ケースDとEは、他のケースと比べて古いアプローチだったりネットワークが小さかったり、オープン・イノベーションの特徴が弱い、詳しく説明していなかった。先生のご指摘通り、きちんと異なるオープン・イノベーション実装と結果の関係性を説明すべく、**最終稿で加筆する。**)

4. I have a similar question as Prof. Mano. Can you deny the possibility of open modular innovation with only one case? I think the failure of case B (Ewatt Technology Co., Ltd.) is not because of the open innovation implementations, but due to the bad management. Could you explain your reasons?

(真野先生も指摘したが、Modular innovationにOpen innovationの適用性は、ケースBだけでは否定できないと思う。Open modular innovationの可能性についてどう思うか。)

A: In this research, we deny the applicability of open innovation in modular innovation situations by both the game theoretical model (Game 1.3) and the failed case B (Ewatt Technology Co., Ltd.). However, it is insufficient to deny all the possibilities with only one case.

Therefore, **in the final revision: 1) we will add another case (which we have discussed in the intermediate report) of modular innovation; 2) we will discuss the conditions of open modular innovation further.**

(本研究では、ゲーム・モデル (Game 1.3) とケース B の両方を用いて Modular innovation の場合の Open innovation を否定したが、一つの反例では不十分なので、最終稿では : 1) 中間試験で討論した Modular innovation のケースをもう一つ追加する。 2) 結論の範囲をきちんと説明する。)

5. I think the insights of your research are too generalized. You should explain the conditions of the insights based on the research questions you have set.

(論文の結論を広げすぎた気がする。主張の範囲をはっきりすべきだと思う。)

A: Yes, we should limit the insights down with the conditions of our research. **We will revise the section of insights.**

(ご指摘通り、主張の範囲を限定するよう修正する。)

樋口先生 :

1. Could you explain the relationships between the Schumpeterian innovation theory, Chesbrough's open innovation theory, and the Henderson-Clark model?

(Schumpeter のイノベーション理論、Chesbrough のオープン・イノベーション理論、及び Henderson-Clark モデルの関係性を説明せよ。)

A: Both Chesbrough's open innovation theory and the Henderson-Clark model are based on the Schumpeterian innovation theory.

Schumpeterian innovation theory has roughly two sources of new combinations (creative accumulation (incremental innovation) and creative destruction (radical innovation)) and five outputs of the innovation (new product, new method of production, new market, new material, new organization of production).

The Henderson-Clark model expand the sources of new combinations to the combinations of 1) core concepts / technology and 2) linkages of core concepts and components / market. The Henderson-Clark model added the architecture innovation and modular innovation to the Schumpeterian innovation theory.

Chesbrough's open innovation theory removes the barrier of innovation. Open innovation theory focuses on the combinations of internal and external ideas, knowledge and resources. While Schumpeterian innovation theory and the Henderson-Clark model only concerns about "closed" innovation inside an organization, open innovation theory suggests that innovation can be achieved through the new combinations of internal and external components.

(Chesbrough のオープン・イノベーション理論と Henderson-Clark モデルは Schumpeter イノベーション理論の拡張であり、社内外による「新結合」や architecture innovation、modular innovation などの概念をイノベーション理論に追加した。)