

Time schedule

- Special issue platform open: 2019, January
- Open the publishing system: 2019, June 1st.
- Closing this special issue platform: 2019, December 30th.

Shooting Method

Manuscripts should be submitted online at www.mdpi.com by registering and logging in to this website.

Publishing Plan of This Special issue

We want to publish until 30-40 papers which are presented at SOItmC 2019 including in advance selected 37 papers.

Special Issue Paper List (47 Papers)

No.	Paper Title	Authors (* corresponding Author)	First or Corresponding Author
1	Lean Smart Manufacturing in Taiwan -Focusing on the Bicycle Industry-	Lih-ren Li	Lih-ren Li
2	Effectiveness of Faculty Development Program for a MBA Course in Myanmar	Aung Kyaw* & KhinSandar Thein	Aung Kyaw*
3	Creating Flow for the Shorter Lead Time-SCCC to Support "Productivity Revolution"	Makoto Kawada	Makoto Kawada
4	Evolving and Shaping Dominant Design of Electronic Bicycle-Comparative analysis of 3 cases, Daegu South Korea, Naples, Italy, and Nagoya, Japan	JinHyo Joseph Yun*, Xiaofei Zhao, KyungBae Park, Yuri Sadoi	JinHyo Joseph Yun*
5	The Collective Intelligence and	JinHyo Joseph	JinHyo Joseph

	Open Innovation-Comparative analysis of automotive and Pharmaceuticals Industries of Korea	Yun*, Euseob Jeong*, Kim KyungHun, SungDeuk Hahm	Yun*
6	Is social innovation a better way to do CSR?	Ching-Hui TANG, Ying-Che HSIEH	Ching-Hui TANG,
7	Understanding the Post-entry of Chinese Firms' ODI: Perspective of Springboard	Xinyue Zhou, Yang Cheng, Lei Ma & Olav Sørensen	Xinyue Zhou
8	A Strategic Architecture of Sustainable System Development Education for Industry, Innovation, and Global Value Creation with SDGs	Min-Ren Yan	Min-Ren Yan
9	Collaborative Green Business Ecosystem and Strategic Development with Open Innovation Platform	Min-Ren Yan & Jen-Ming Weng	Min-Ren Yan
10	Patent Risk Evaluation in International Trade Based on the Analytic Hierarchy Process and Entropy Method	Ben Zhang*, Lei Ma, Zheng Liu, Fuxin Wang	Ben Zhang*
11	OPPORTUNITIES PRESENTED BY CRISIS : THE UPGRADING OF CHINA PHOTOVOLTAIC	JIN Jun	JIN Jun
12	An analysis of converged core capacity affecting team creativity of industrial workers	Eun-Joo Kim, Hang-Sik Park*	Hang-Sik Park*
13	The Effect of Innovation	SeungHoo jin,	SeungHoo jin

	Capabilities on Business Performance: Focused on IT and Business Service Companies	SangOk Choi	
14	What Determines Organizational Innovation in Public Sector?	GyeongMin Nam, SangOk Choi	GyeongMin Nam
15	The roles of business network centralities on firm performance: An explorative study in Tokyo manufacturing	Antonio K.W. Lau, Zhao An	Antonio K.W. Lau
16	Open Collaborative Innovation in Informal Economy: The Emergence of Shenzhen Mobile Phone Industry	Yu-Chun Chen, Chen, Min-Nan	Yu-Chun Chen
17	Analysis of Factors Influencing the Matching of Ride-Hailing Service using Machine Learning Method	Myungsik Do*, Wanhee Byun, Hoyoung Kee, Hyeryun Jin	Myungsik Do*
18	A Data Mining Method of OLED Patent Technology in Chemical-Field Based on Content Analysis	Jiang Wang, Lijuan Wang	Jiang Wang
19	Integration of Kano's Model into QFD for Product Design	Ulugbek Kirghizov, Choonjong Kwak	Choonjong Kwak*
20	Differences of Perceived Difficulties by User Groups with Use of Rehabilitation Robot Prototype	Taesun Kim	Taesun Kim
21	A virtuous circle job model of	Aesun Kim &	Minhwa Lee*

	4th Industrial revolution	Minhwa Lee*	
22	The 4th Industrial revolution and Smart revolution	Kangjin Ju & Minhwa Lee*	Kangjin Ju
23	A Repository Architecture for the Start-up Business Process	Hokyeom Kim, Junghyun Yoon & Sanghyun Sung*	Sanghyun Sung*
24	Public Service Motivation and Attitudes toward Sustainability	Kwangho Jung, Seung-Hee Lee, Jane E. Workman, Xiufeng Li	Kwangho Jung
25	The Effects of Technology Entrepreneurship on Employment Change	Daesoo Choi, Chung-Gyu Byun, Kyung Hee Jung, Chang Soo Sung*	Chang Soo Sung*
26	A Study on the Effects of Entrepreneurship Education on occupational choice: Mediating effect of Bricolage	Yu Shin Kim, Chang Soo Sung	Yu Shin Kim
27	How Do Relational and Organizational Characteristics Affect Joint Knowledge Creation in the Period of the Post-Merger Integration?	Jeonghwan Lee, In-Jong Lim, Jinju Lee	Jeonghwan Lee
28	A Study on the Factors Influencing Public Technology-based Start-ups	Injong Lim, Jeonghwan Lee, Maeng, Cheol-Kyu	Injong Lim
29	Business model with sharing economy under the smart city	Junghee Han, Almas Heshmati	Junghee Han
30	Study on preventive measures against exposure to risk	Junghee Han	Junghee Han

	factors, causing industrial disasters		
31	The Classification Analysis of Social Entrepreneur and Its Related Factors: Using Latent Class Analysis Method	ChangHwan Shin, Jungkyu, Park	ChangHwan Shin
32	Bridging the Gap in the Commercialization Process of Digital Innovative Technology: Focusing on 3 Stage Technology-Product-Market Model	Minseo Kim, Sun-Young Park* & Hyesu Park*	Sun-Young Park*
33	A Study on Profile and Investment Decision-making Factors of Informal Investors for Start-up Investment	Tae Nyeun Kim, Yeong-wha Sawng & Sun-Young Park*	Sun-Young Park*
34	An empirical study on the obstacle factors affecting R&D outsourcing on a basis of Innovation Resistance Model: Focus on the Automotive R&D in Korea	Jinhyung Kim, Sun-Young Park & Minseo Kim*	Minseo Kim*
35	A Study on the Impact of the Innovation Capabilities of Service Firms on the Performance in the Global market: Focusing on the Interaction Effect of Service R&D	Sun-Young Park, Kihin Wo* & Minseo Kim	Kihin Wo*
36	Factors affecting merger and	Jimin Choi;	EungdoKim*

	acquisition performance in pharmaceutical industry	EungdoKim*; KwangsooShin	
37	Developing evaluation framework for selecting optimal medical devices	Juhyuk Park; KwangsooShin; EungdoKim*	EungdoKim*
38	Study on the Prediction of Economic Lifetime for Converging multi-component technology and its Application to Practical Cases for Technology Valuation	Tae-Eung Sung; Eungdo Kim; Kwangsoo Shin; Jongtaik Lee*	Jongtaik Lee*
39	Platform Growth Model: The Four Stages of Growth Model	Junic Kim	Junic Kim
40	Intangible Resources and Internationalization for the Innovation Performance: An Empirical Evidence from Chinese Organizations	Yuhan Liu, Jaewook Yoo, Junic Kim	Yuhan Liu
41	How to create collective intelligence for successful open innovation	Namjun Cha*; Junseok Hwang, Eungdo Kim, Hosoo Cho	Namjun Cha*
42	How Big Data Contributes to the Building of Citizen-Centric Smart Cities: The case of Namyangju City in Korea	Daesung Jun, Eunmi Lee, Loni Hagen, Hyewon Lim, Dongwook Kim	Daesung Jun
43	Paradox of Long Tail Effect in Smart City: Analyzing citizen complaints	Eunmi Lee	Eunmi Lee

44	Graduate school education for regional innovation	Norihiro Nishimura	Norihiro Nishimura
45	Regional innovation by practical method to the local situation	Daisei Okayama, Norihiro Nishimura*	Norihiro Nishimura*
46	Opening the 'black box': The mechanism and effects of board power hierarchy to green governance performance-moderated by the corporate mission	Yongzhen Xie*, Feiran Dong & Linjun Cao	Yongzhen Xie*
47	The construction of the AI model of medical beauty tourism marketing - from the perspective of brand	Chi-Hsuan Lin, Wei-Chuan Wang, Yu-Ting Chen	Chi-Hsuan Lin

1.

Lean Smart Manufacturing in Taiwan -Focusing on the Bicycle Industry-

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Abstract

Purpose/ Research Question:

The purpose of this paper is to analyze the impact of smart technology centered on the IoT on manufacturing activities, then combine the Lean Production System and industry 4.0 to propose a new structure of Lean Smart Manufacturing, and to do empirical research about A-Team and Giant in Taiwan's bicycle industry. It is not only the realization of Lean Smart Manufacturing, but also further explores the two solutions proposed in the new architecture, especially the implementation of the strategic co-creation platform to examine the mechanism of the bicycle industry and enterprises to strengthen their competitiveness.

Key Literature Reviews (About 3~5 papers):

Storbacka, K. (2011) developed solution business model framework. The framework consists of a solution process with four phases (develop solutions, create demand, sell solution, and deliver solution) and three groups of cross-functionality issues (commercialization, industrialization, and solution platform). They points to the importance of cross-functional alignment within firms. An effective solution business model requires the intricate coordination of resources and business processes across all functions. Nobeoka (2017) pointed out that there are changes of customer value into tacit nature in the past few years. Due to the tacit of customer value, the value sought by customers is difficult to express, and it is necessary to create value with customers.

Rüßmann, M. et al(2015) pointed out that Industry 4.0 redefines the life cycle of R&D, manufacturing, logistics, and after-sales service, affecting producers' entire value chain. For example: (1) insular manufacturing cells will be replaced by fully automated, integrated production lines, (2) products, production processes will be designed and commissioned virtually in one integrated process and through the collaboration of producers and suppliers, (3) manufacturing processes will increase in flexibility and allow for the economic production of small lot sizes, (4) manufacturing processes will be enhanced through learning and self-optimizing pieces of equipment, (5) automated logistics will adjust automatically to production needs. In this way, in the production process, the production cycle and lead time can be shortened, and the production efficiency can be improved, and a large number of customized small-volume production can be realized, and the production quality can be improved through deep learning.

Porter, M.E. & Heppelmann, J.E.,(2015) said that through IoT, smart products are connected to each other, data has changed the value chain of enterprises and created new values. On the one hand, enterprises have also faced new strategic judgments, which in turn affect their value activities. Industry 4.0 forces the manufacturing industry to think about the business strategy and business model of the enterprise. The smart network system shifts the focus of the supply from the product to the service, which means "servitization" and

customization. It have Changed from "production" to "production+service" or service-oriented.

Industry 4.0 and Lean Production can work together to add value to users (Kolberg, D. & Zühlke, D., 2015). A process orientated organization and thus, Lean Production System might be an enabler towards a successful and sustainable implementation of Industry 4.0 in the production environment, that is, Lean builds the basis for Industry 4.0, while Industry 4.0 advances Lean Production System (Dombrowski, U. et al., 2017). Lean Production has proven to be a valuable methodology to improve productivity while reducing costs, but it still have limitations, especially in production environments characterized by demand volatility, high product mix and reduced lot sizes. Technology of Industry 4.0 is a potential solution to such limitations (Mora, E. et al., 2017).

Li, Lih-ren et al.(2018) pointed out that smart manufacturing that drives manufacturing innovation is a self-disciplined factory which responds to individual customer needs through the interaction of the physical system of the factory and the cyber system. It consists of three fields (Figure 1). The first is the realm of the physical system, and the second is the field of the cyber system. The third is the solution platform, which is built to make the overall system operate effectively (Storbacka, K. & Pennanen, R., 2014). The first solution platform of Lean Smart Manufacturing is placed in the physical system, which consists of three elements: digitization, connection and intelligence, while the second solution platform focuses on strategic co-creation.

Design/ Methodology/ Approach:

First of all, in the context of the bubble of Industry 4.0 and the rise of Lean Smart Manufacturing, review the research trends and connotations of Industry 4.0, and explore the latest theories related to the Lean Production System and Industry 4.0 to support and further explain the previously proposed architecture and solution platform for Lean Smart Manufacturing. Secondly, it explains the mechanism and connotation of A-Team constructed in Taiwan's world-famous bicycle industry cluster. Finally, it examines the practice of the architecture and solution platform of Lean Smart Manufacturing for the main members of A-Team, and further explore its implications(Figure 1).

Research limitations/ Implications:

Hujimoto (2017) has divided the relationship between Industry 4.0 and digitalization into three layers: High Sky (ICT System = Weightless World), Low Sky (FA-ICT Interface = Middle Range), and Ground (FA System, Manufacturing Site = Weighty World). And he pointed out that the main battlefield for manufacturing is the huge Low Sky, which is recommended to build cross-enterprise network standards.

The empirical research can prove the importance of combining industry 4.0 with Lean Production and the importance of creating an open innovation platform under the trend of a large number of customization and manufacturing service. To jointly establish a strategic co-creation platform, effectively integrate customers, R&D resources and suppliers, and deliver smart logistics to customers by smart factories with differentiated advantages, can create a win-win situation.

The results of this case study, as we advocate the development of Lean Smart Manufacturing that can utilize the advantages of industry and individual enterprise differentiation, pragmatically proceed from the establishment of the smart factory platform of the physical system, and gradually extend to the strategic co-creation platform of the cyber system.

Keywords:

Customer Value, Industry 4.0, Lean Production, A-Team

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2.

Effectiveness of Faculty Development Program for a MBA Course in Myanmar

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Abstract

Purpose/ Research Question: The purpose of the present study is to evaluate the training program for the faculty members of a MBA course at a university in Myanmar. More specifically, as one case of efforts on training of trainers (ToT), the analytical focus is on identifying training effectiveness, such as knowledge and skills acquired as well as 'training transfer' (application of knowledge and skills acquired back to the workplace).

Key Literature Reviews (About 3~5 papers): In terms of theoretical discussion on the topic, the field of human resource development studies has dealt with this issue, for example, regarding theoretical discussion from the standpoint of industrial and organizational psychology (Latham, 2003) and the importance of learning knowledge and skills on training transfer by current and prospective trainers participating in ToT. (Hutchins, Burke & Berthelsen, 2010). There have been several empirical studies analyzing effectiveness of ToT, though mostly they are conducted in the case of medical education and training, mainly from the practical perspectives. We have not found studies in the case of the faculty members at university, particularly at MBA courses. Even though teaching

experiences of trainers for medical professions and MBA students are not exactly the same, we expect considerable degree of similarities between the two, as both are professionals. For example, according to a systematic review of ToT regarding employees in medical and social welfare sectors, it was effective to adopt the integrated approach such as supporting interactive learning by study manuals, for the various outcomes including knowledge and skills acquisition, behavioral change (=training transfer), and outcome at the level of those supported like patients (Pearce et al., 2012). This sort of result should be utilized in the present study for developing the ToT program. The other important point is the prior studies made their analyses in Western developed countries only, although ToT has been commonly utilized as a practical approach in development assistance. In this regard, it is considered that the studies on Asian developing countries such as the present study have a significance from both academic and practical perspectives.

Design/ Methodology/ Approach: The subjects are early career faculty members (tutor and assistant lecturers) currently or prospectively working for a MBA course at a university in Myanmar. They will participate in a training program in order to teach in-service graduate students who have working and business experiences and have more practical understanding of learning than and different learning styles from those who have no substantial experiences at work. The training program consists of two parts. One is series of lectures while the other is continuous monitoring and feedback. Lectures are mainly on the knowledge and skills for teaching, especially based on interactive and action learning methods, as the aspect has not been learned extensively by the faculty members and it is likely to be more effective for in-service MBA students who have actual business experiences. The other part, continuous monitoring and feedback will be randomly assigned to half of the program participants. The researchers implemented monitoring for their application of knowledge and skills in classes and give them the feedback.

Data collection will be multi-wave based. Before the lectures, their initial knowledge and skills will be evaluated by the placement test. Moreover, their characteristics (self-efficacy, learning readiness and demographic characteristics) as well as perceived work environment (support from supervisors and peers, and opportunities to use) will be collected. After the lectures, same information will be collected. Then after the teaching at a MBA course, retention of the knowledge and skills will be evaluated while the degree of application in classes for MBA students will be also collected. In terms of knowledge and skills acquisition, we will compare the levels before and after the lectures by t-test. The effects of trainee characteristics and perceived work environment will be analyzed by structural equation modeling. Although we do not have a control group, we consider collecting the level of relevant knowledge and skills among other faculty members for our reference. As for the retention and application, the level difference between treatment and control groups will be identified by t-test. Moreover, similar kind of structural equation modeling will be conducted as that for the knowledge/skills acquisition model.

(Expected) Findings/Results: We expect the ToT program would be effective to lead to knowledge and skills acquisition and its application at the MBA course. More specifically, knowledge and skills will be significantly improved after the lectures while the retention and application will be at the higher level when the program participants will receive monitoring and feedback. Moreover, learner readiness, self-efficacy and supportive work environment will have positive direct effects on all the training outcomes and the positive moderating effects on the relation between the additional intervention (monitoring and feedback) and the outcomes (retention and application) after the teaching implementation at the MBA course.

Research limitations/ Implications: Especially in terms of knowledge and skills acquired, the effect of the program cannot be articulated rigorously, because we will not compare treatment and control groups due to the research design. The results are expected to suggest that universities should implement the faculty development program of the same kind including monitoring and feedback during the participants' involvement in teaching courses for in-service MBA students.

Keywords: Training of trainers; training effectiveness; MBA course

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3.

Creating Flow for the Shorter Lead Time: SCCC to Support “Productivity Revolution”

- Makoto Kawada, Professor Emeritus, PhD. Meijo University, Japan

Abstract (Expanded)

Purpose/ Research Question:

The Japanese Government has announced “Productivity Revolution”. Then, we have to define “productivity” and “Revolution” in terms of management system design and knowledge sociology.

Following the context of the Sociology of Knowledge, social practices are not natural phenomena, but a culture tentatively organized by specific environmental conditions, we can assume two kinds of knowledge pattern regarding the manufacturing productivity. One is the “Resource Operation Productivity” that was organized by Ford Motors in the US in the early 20th century, the implication of which is “Men or machines should work more and produce more”, and this productivity notion was supported by F. Taylor’s “Scientific Management” However, this productivity notion was challenged by the “Lead Time Productivity”, initiated by Toyota Japan in the 1970s, the implication of which was “Materials should flow as faster as possible” . Therefore, “Revolution” implies the paradigm shift of the knowledge from “make-to-stock” to “make-to-order”, or more simply, shifting the focus of management science from “volume” to “velocity”

The superiority of Lead Time Productivity (Lean-TPS) became almost “de-facto standard”. However, in reality, Implementing TPS is considered to be difficult. The reason for the difficulty lies in the problem of knowledge pattern. For those who have once acquired the knowledge of "Resource Operation Productivity" , it becomes extremely difficult to switch their mindset to the "Lead Time Productivity". On the other hand, there are facts that those who have not the old knowledge can successfully create flows by Lean-TPS, which in Brazil, Malaysian, Turkish and so forth. These facts led us to the following hypothesis.

A new hypothesis : “Lean-TPS is Easy, but Depending on Conditions.

Lean-TPS can be introduced in a surprisingly short time when three conditions are satisfied.

"Three conditions" are -

- ① The president's own seriousness in creating flow.
- ② Managers and employees acknowledge immediately the advantage of the smaller batch production, for example, through playing "half-day paper airplane folding game".
- ③ Accountants at HQ can theoretically explain the superiority of “Lead time Productivity” over “Resource Operation Productivity”.

Actually, some Malaysian company reached the "one-piece flow" level within half a year from the start by fully sufficing these three conditions.

However, conversely, it means that if any one of these three conditions fails, Lean-TPS is impossible to introduce. In other words, it can be said that "creating flow" can be either achieved within a marvelously short period of time, or impossible to introduce forever.

Design/ Methodology/ Approach:

Interdisciplinary observation tells us that among the above three conditions, both ① and ③ are related to the way to deal with Financial KPI(Key Performance Indicator). For example, once CEO and/or CFO designate “fiscal profit” as KPI, the company can never implement Lean-TPS. On the

other hand, if they designate “inventory turnover days” as KPI, the success ratio is enhanced considerably. Following this context, this paper deals with two financial KPIs : CCC linked with the “Resource Operation Productivity” and “SCCC” linked with the “Lead Time Productivity”.

Findings / Results: Difference between SCCC and CCC

The difference between the US-born CCC and Japan-born SCCC is small, as SCCC changed one *minus* mark in the CCC equation to *plus*, and just added one capital letter “S (Supply chain)” to CCC. But these slight alteration has a great divide in its implication.

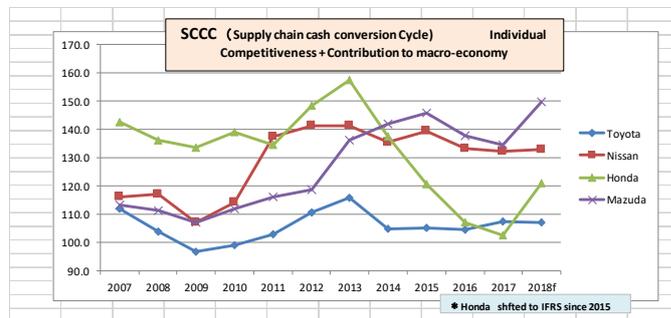
CCC (cash conversion cycle)

= Inventory Turnover Days + Account Receivables Turnover Days - Account Payables Turnover days

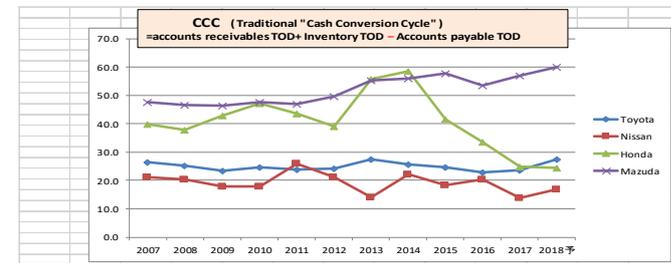
SCCC (Supply Chain Cash Conversion Cycle)

= Inventory Turnover Days + Account Receivable s Turnover Days + Account Payables Turnover days

< SCCC vs. CCC in Japan’s four auto manufacturers >



SCCC=Lead Time Competitiveness + Contribution to the macro economy												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Toyota	111.9	104.1	96.8	99.2	102.9	110.8	115.8	104.8	105.3	104.7	107.6	107.3
Nissan	116.0	117.0	107.1	114.2	137.4	141.4	141.5	135.5	139.4	133.4	132.3	133.0
Honda	142.5	136.2	133.7	139.1	134.6	148.5	157.6	137.3	120.5	107.1	102.7	121.1
Mazuda	113.3	111.2	107.2	111.8	116.1	118.9	136.2	142.0	145.9	137.7	134.5	149.6



Lead Time to Acquire Funds (Traditional CCC)												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Toyota	26.4	25.1	23.4	24.8	24.0	24.2	22.5	25.6	24.6	23.0	23.7	21.4
Nissan	21.2	20.5	17.8	17.8	26.0	21.2	14.0	22.2	18.3	20.4	13.9	16.9
Honda	39.8	37.8	42.9	47.2	43.8	39.2	55.7	58.7	41.5	33.5	25.0	24.4
Mazuda	47.8	46.8	46.3	47.8	46.9	49.7	55.3	58.0	57.7	53.6	56.9	60.0

It turns out Nissan's "shorter than Toyota CCC" depends on the later payment to suppliers. CCC notion thus contradicts to the national strategy for growth. But, CCC is available for internal fund management, lead time. Honda's CCC since 2015 are unreliable (Shifted to IFRS). IFRS can not be used for internalmanagement.

Nissan's CCC is lower than Toyota, but SCCC is worse than Toyota, which implies that Nissan's apparently better CCC is due to the later payment to subcontractors. The velocity of both material and monetary flow(SCCC) of Toyota is faster than Nissan. Thus, it is clear that SCCC can more accurately measure the "Lead Time Productivity" than CCC.

The reason why the Japanese Government adopted SCCC instead of CCC as KPI in 2017.

FinTech Committee of METI (Ministry of Economy, Trade and Industry) of Japanese Government told that "minus mark for payables" induces to "collection be quick but payment be as late as possible" mindset with negative effect on the cash flow of suppliers. Whereas, "plus mark of payable" works for the faster monetary flow for the supply chain as a whole, which will be reasonably realized by means of FinTech.

Research Implications of the knowledge pattern

Knowledge Pattern Comparison		
	CCC	SCCC
productivity	resource operation (Volume)	lead-time (Velocity)
science	local optimum / divisionism	total optimum / interactionism
management	Fundamentalism or neoliberalism	three ways good
society	selfishness (Serve your own advantage)	altruism (serve thr next process)

Findings/ Results: Japan's monetary flow is inferior to Germany!

2009-2015 Ave. Days : S C C C Japan Germany Comparison				
Automobile Auto parts	①Account Receivables	② Inventories	③ Account Payables	S C C C ①+②+③
Japan	57	51	61	169
Germany	48	75	34	157
Heavy Electric Non-listed (SME)	①Account Receivables	② Inventories	③ Account Payables	S C C C ①+②+③
Japan	70	30	85	185
Germany	22	84	35	141
Manufacturing Industry Total	①Account Receivables	② Inventories	③ Account Payables	S C C C ①+②+③
Japan	66	74	85	225
Germany	54	120	50	224

What was found in the survey report of Teikoku Data Bank, Ltd is that apart from "inventory turnover days", SCCC value, Japan is inferior to Germany in the area like "automobile industry", or in the field of "unlisted small SMEs. The SCCC of the "manufacturing industry as a whole", although Japan excels Germany by 50

days in terms of “inventory turnover days”, but inferior to Germany by 50 days in terms of “receivables and payables turnover days”.

Conclusion: Japan is much retarded in terms of the velocity of monetary flow. This is an important point of Japan’s “Productivity Revolution”

Keywords:

“Productivity Revolution”, knowledge pattern, Resource Operation Productivity, Lead Time Productivity, SCCC, Financial accounting to support Production management

Key Literature Reviews

Stark. W [1956] : the author of this paper actually tried his approach of the sociology of knowledge. As shown in page 3, the knowledge of SCCC and CCC can be depicted as a reflection of cultural factors like productivity, science, management and society.

Kawada, M. and Johnson.D [1993] : This paper that received (Certificate Appreciation Award, 1993-1994) proposed the “lead-time based costing” that reflected lean-TPS thinking in which hourly burden rate should be based on lead time including waiting time. The notion of SCCC of this paper is the advanced type of lead time concept as it involves both material and monetary(cash) flows .

Johnson, T and Bröms, A [2000] : This book was the declaration of Tom Johnson’s departure from the research of “management by accounting ” like ABC (Activity Based Costing) to the research of “management by process like Toyota, the background of which was the suffering of American manufacturing industry.

Kodama (2018): New modes of technological learning and new strategic concepts are necessary.

Becker (2018): The role of the state to fulfill the demand of social welfare.

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4.

Evolving and Shaping Dominant Design of Electronic Bicycle

– **Comparative analysis of 3 cases, Daegu South Korea, Naples, Italy, and Nagoya, Japan**

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Xiaofei Zaho KyungBae Park

Yuri Sadoi

1. Research Question

As the appearance of the 4th industrial revolution, so to say the 2nd information technology revolution, open innovation paradigm is spreading the way to conquer the growth limits of capitalism (Yun, 2015). In the way, open innovation can trigger new emergence even though it also grows the complexity belonging sector. So, the appearance of dominant design in the open innovation strategy under the 4th industrial revolution can be changed in speed, and situation (Yun, Won, & Park, 2016).

Architecturally, the bicycle in components such as brakes, pedals, cranks and hubs themselves have been upgraded considerably through a process of incremental innovation, but the way that the components operate and how they link together to form a functional product has changed little since the establishment of a dominant design in the 1890s (Galvin & Morkel, 2001). So to say, bicycle industry has already matured before 20th century. But, with the developing of electrical battery, and the surging of environment issue, diverse electronic bicycle designs are appearing in the market. Technology paradigm is shifting and new technological trajectory is evolving in electronic bicycle industry now (Dosi, 1982). Even though after the appearance of dominant design passed more than 100 years, if there is more “learning by doing” associated with more capital-intensive techniques such as electronic bicycle, the rate of technological change may be increased again in electronic bicycle (Atkinson & Stiglitz, 1969).

How does the electronic bicycle evolve and does dominate design shape?

What is the difference in the evolution and appearance of dominant design of electronic bicycle between Daegu, Naples, and Nagoya?

2. Literature Reviews and Research Framework

2.1. Literature Reviews

Dominant design is a design which wins the allegiance of the market place what innovators or

competitors must adhere to (Utterback, 1994). Dominant designs emerge from competitions in the product life cycle after a long process of problem solving (Gawer & Cusumano, 2014). Dominant can motivate the process innovation, but can decrease the radical innovation (Brem, Nylund, & Schuster, 2016). Dominant design does the role of a milestone of change by displaying one or more of following qualities, 1) Technologies which lifts fundamental technical constraints limiting the prior art while not imposing stringent new constraints; 2) Designs which enhance the value of potential innovations in other elements of a product or process; 3) Products which assure expansion into new markets (Abernathy & Utterback, 1978).

There is a trade-off relation when the dominant design can be imitated between 2 choices such as 1) A firm enters early in order to gain first mover advantages; 2) The firm waits in order to minimize the probability of losses associated with choosing a product design that does not emerge to dominate (Tegarden, Hatfield, & Echols, 1999). If firms enter during the early stage of any industry, must adapt to different rules of competition under the subsequent period of incremental change, in addition to switch to the dominant design (Abernathy & Utterback, 1978; Teece, 1986). An evolutionary model of technological change is proposed in which a technological breakthrough, or discontinuity, initiates an era of intense technical variation and selection, culminating in a single dominant design (Anderson & Tushman, 1990).

According to the markets for cameras, road vehicles, amplification systems, or personal computers, dominant designs appear during through coevolutionary-learning as the emergence of market niches (Windrum, Birchenhall, & Dynamics, 1998). According to this, dominant design can have 2 opposite sources such as artefact and knowledge dimension of technology, and population learning by firms and consumers. If central firms as information gateway with network of firms community lead collective actions through density and repeated partnerships, and arrive at the emergence of a dominant design, it is a kind of technology paradigm based dominant design (Soh, 2010). The continuous changes which are often related to progress along a technological trajectory, so to day technological paradigm, and the discontinuity of technology which is associated with the emergence of a new paradigm express technology based dominant design (Dosi, 1982).

The VHS format as the dominant design in the area of video-cassette recorders, despite technological weakness relative to the competing Sony Beta format, is the impact of factors such as network externalities and appropriability, which may profoundly moderate product commercialization but appear by and large neglected in the marketing perspective (J. R. Lee, O'Neal, Pruett, Thomas, & Management, 1995). So to say, non-technological factors such as the user in influencing the adoption of a new design, networks of organizations, or historical events may also dominate the emergence process of dominant design (Anderson & Tushman, 1990; Arthur, 1989; Tushman, 1992). In automotive industry, even though several technologies have been proposed to replace the conventional engine, most notably the fuel-cell vehicle (FCV), and vast support from the automotive industry for this long-term technology, another technology, the hybrid electric vehicle (HEV) has been opening the market as a candidate for the dominant design in the automotive industry in favor of the FCV (Hekkert & van den Hoed, 2004).

So to say, the emergence of a dominant design can be explained as the results of the interplay between technical and market choices because a dominant design is the outcome resulting from a series of technical decisions about the product constrained by prior technical choices and by the evolution of customer preferences (Utterback & Suarez, 1993). The number of firms in an industry-the industry's density is directly affected by the emergence of a dominant design in a pattern that is common to all

the industries in that the population density seems to be directly associated with the industry's technological evolution (Suárez & Utterback, 1995). But In the cases of typewriter industry, automobiles, TV, TV Tubes, Transistors, IC, or Calculators, the emergence of dominant design appears together with the peak of industries (Utterback & Suarez, 1993). This means that the increasing of industry can also motivate the dominant design.

Hypothesis 1. Maturing of the industry, so to day density of the industry with technology evolving and, and market growth will motivate the appearance of the dominant design of electronic bicycle.

According to several literature reviews, technology evolving and market growth motivate the emergence of dominant design by maturing of the industry. So we set up this hypothesis 1.

In HEV case, the environmental conditions including regulations also gave effects on the appearance of dominant design of car engine. The increasing environmental concerns call for deep renewals in existing technologies and traditional dominant design in many industries, for example, several electric Vehicle (EV) dominant design candidates (Midler & Beaume, 2010). Though a technology that by change gains an early lead in adoption may eventually 'corner the market' of potential adopters, with the other technologies becoming locked out, under different insignificant events such as unexpected successes of prototypes, whims of early developers, political circumstances- a different technology system can come to dominate through non-predictable and potential inefficient ways (Arthur, 1989). In the case of learning by using is another way of evolving of dominant design by users, or customers (Atkinson & Stiglitz, 1969; Rosenberg, 1982). Edward Hess received 140 typewriter patents during his lifetime and Hess' typewriter arrived at dominant design he did his best to meet users' requirements such as reduction of typewriter's production costs (Utterback & Suarez, 1993). A dominant design will also embody the requirements of many classes of users of a particular product, so to say the using environment (Suárez & Utterback, 1995). After technological discontinuities, during the era of intense technical variation and selection, using environments with others gives effects to this selection according to longitudinal studies of cement, glass, or minicomputers (Anderson & Tushman, 1990). In addition, with the dawning the fourth industrial revolution, or the spreading of information technology (IT) to all industries, the speed of changing of consuming environment is accelerating with the increase of demand articulation (Kodama & Shibata, 2015; M. Lee et al., 2018).

Hypothesis 2. Using or Consuming environments will trigger the appearance of the dominant design of electronic bicycle.

If you look into several literatures, there are some missing points which explain the emergence of dominant design. So we set up hypothesis 2. During 4 periods of bike-sharing history, several diverse bikes had been shared according to the location, nations, and economic conditions (DeMaio, 2009; Midgley, 2011). Using or consuming environments will give effects the emergence of dominant design of consumer products such as electronic bicycle.

2.2. Research Framework

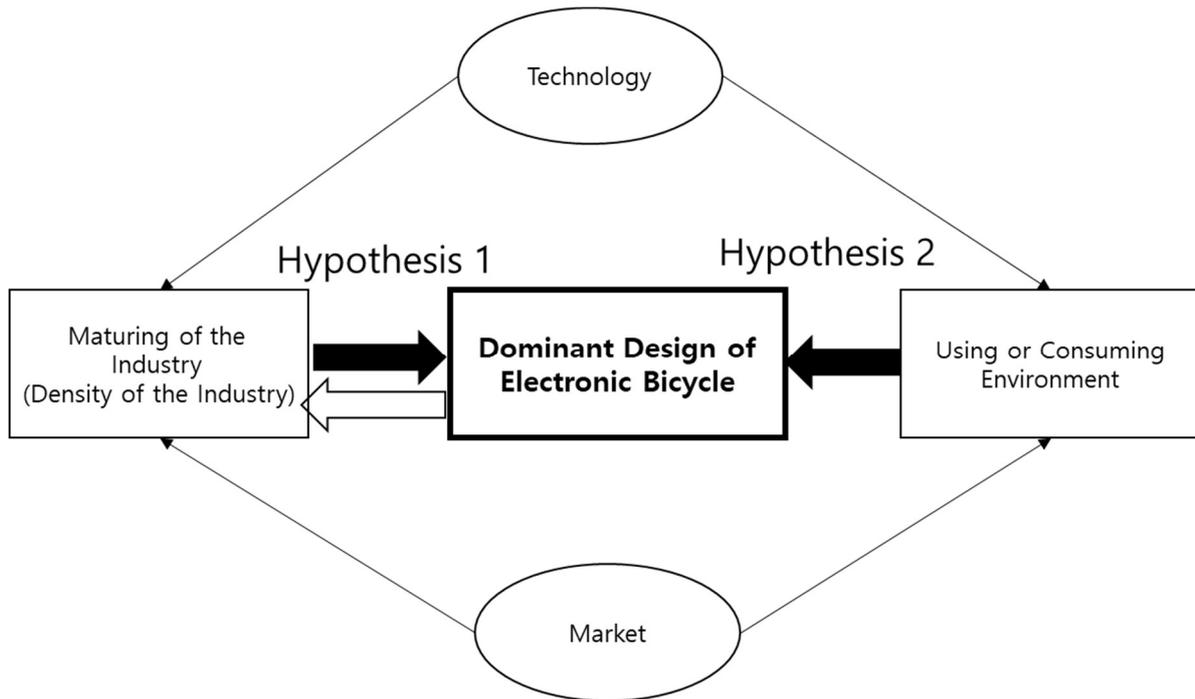


Figure 1. Research Framework for the analysis of dominant design of electronic bicycle.

2.3. Research method

1) Participant seeing.

First, We Stayed at DGIST campus 3 places such as the front of the DGIST Main gate roundabout, DGIST dormitory-inside campus tunnel front, and the door beside the main building of DGIST for 3 days on August 1st-3rd, every day 3 hours (8-11 am). During this seeing, we counted all bicycles, electronic bicycles, and the dominant design electronic bicycles and compare them with other electronic bicycles, and non-electronic bicycle. In addition, we took photos of all of bicycles. We saw the pass way condition for bicycle around the DGIST campus additionally.

Second, we stayed at Naples downtown 3 places such as Via S, Caterina, Via Chiaia, and Via Toselo for 4 days on October 22nd – 25th, every day 3 hours (2-5 pm). During this seeing, we counted all bicycles, electronic bicycles, and the dominant electronic bicycles and compared them with other electronic bicycles, and non-electronic bicycle. And, we took all photo of bicycles which could be taken. We examined the pass way conditions for bicycle around the Naples downtown additionally.

2) Half-structured questionnaire based interview or qualitative research.

First, we distributed the Appendix questionnaire to all bicycle users at DGIST field research, and received answers from 51 of bicycle users of DGIST. To someone of them, we called, and asked additionally about our questionnaire.

Second, we distributed the Appendix questionnaire to nearly 50% of bicycle users at Naples downtown, and received answer a few cases. But, we asked the questionnaire at the place more than 20%.

3. Evolving of electronic bicycle, and shaping of dominant design in DGIST Campus of

Daegu Korea Total number of bicycle=141

Non electronic bicycle = 80 (56.73%)

Electronic bicycle = 61 (43.26%)

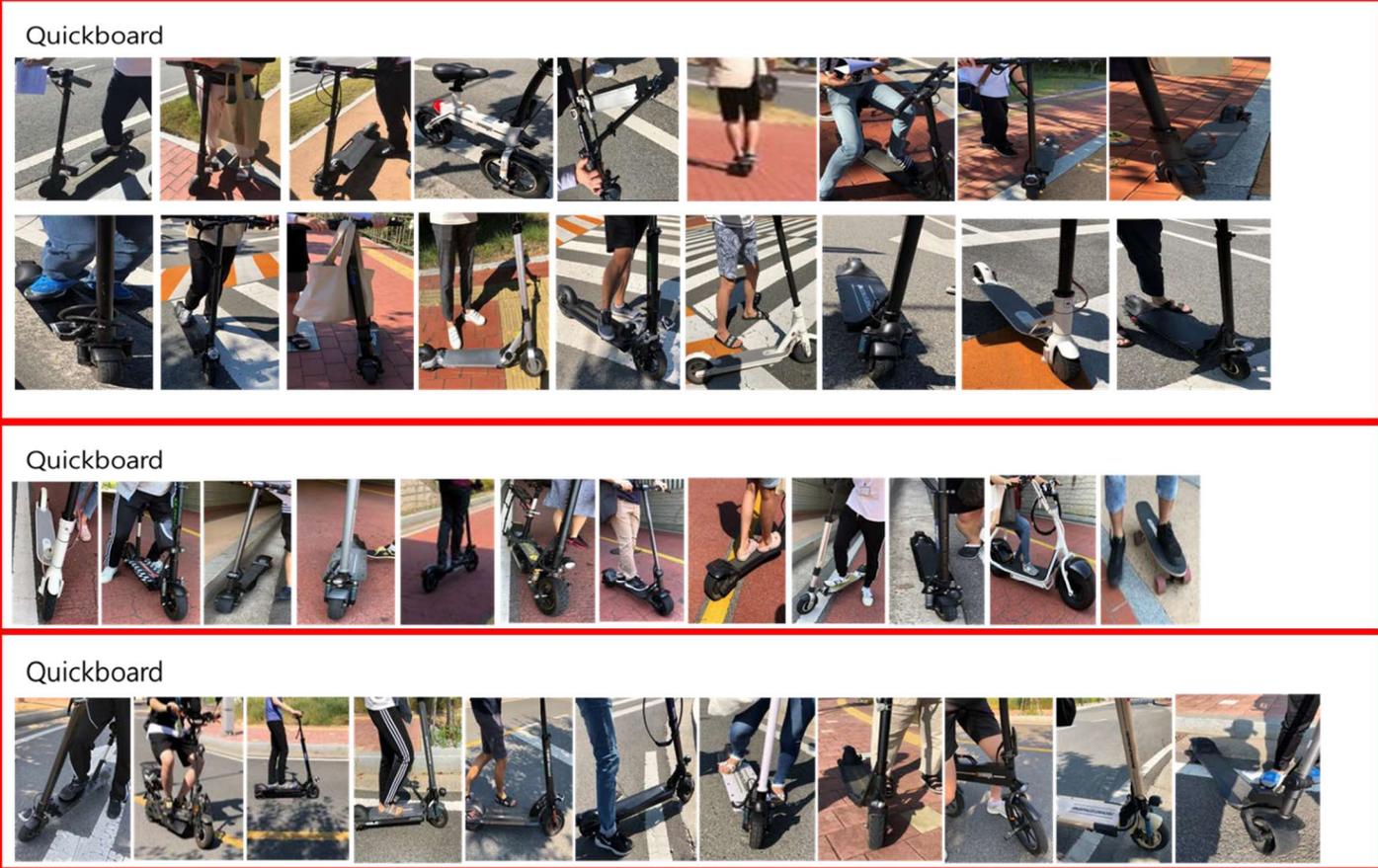
Dominant Design Electronic Bicycle (Electronic Quick Board) =

41 (among electronic bicycle = 67.21%)

(among total bicycle =29.07%)

There is a high diversity in dominant design: Electronic Quick Board as follow figure 2.

Figure 2. High diversity among electronic quick boards in DGIST campus.



4. Evolving of electronic bicycle, and shaping of dominant design at Naples downtown of Italy

Total number of bicycle=349

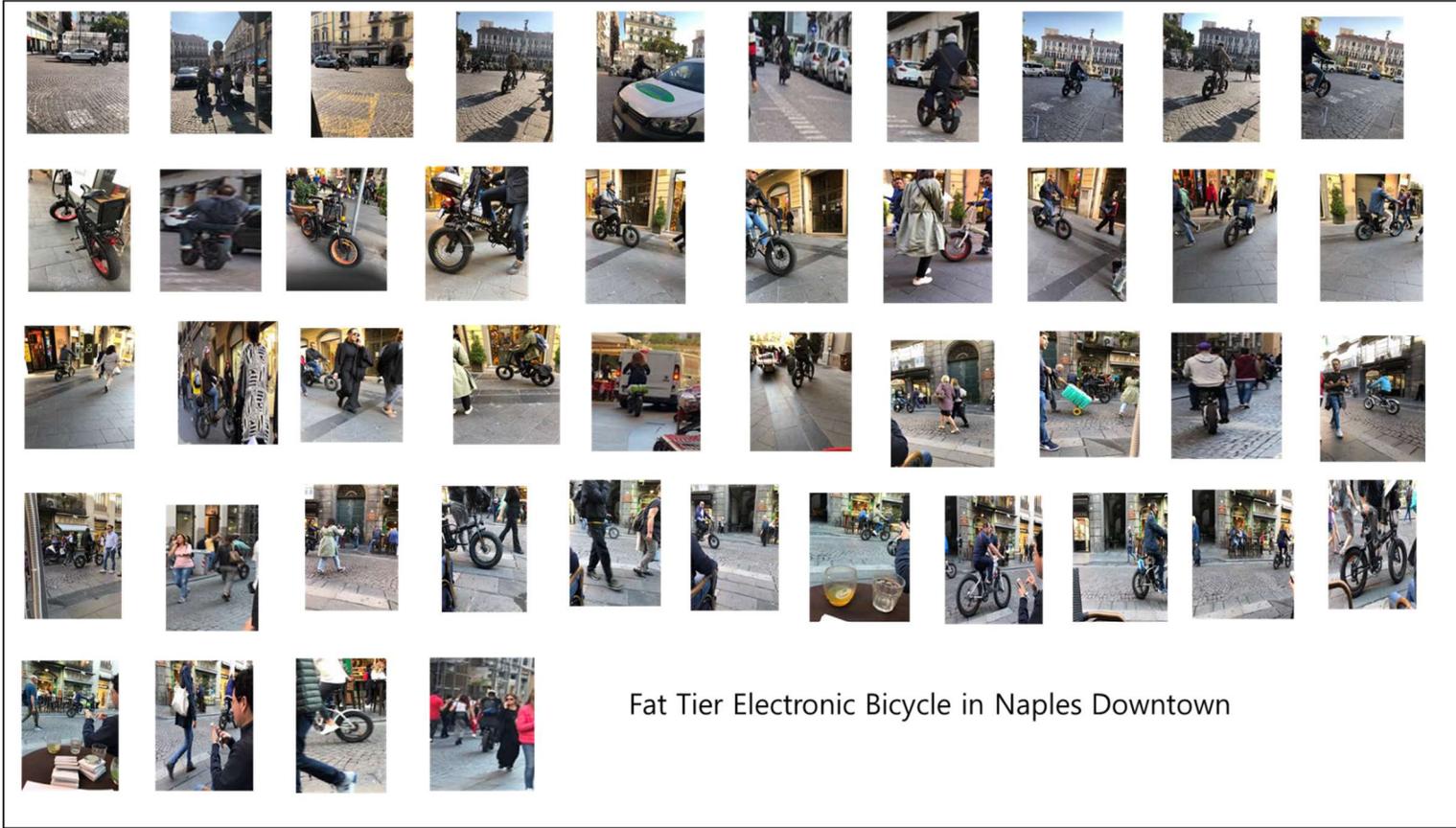
Non electronic bicycle = 172 (49.28%)

Electronic bicycle = 177 (50.72%)

Dominant Design Electronic Bicycle (Fat tier Electronic Bicycle) = 85

(among electronic bicycle = 48.02%) (among total bicycle = 24.36%)

Figure 3. Homogeneous among Fat Tier Electronic Bicycles in Naples Downtown.



<Appendix>

Half-Structured Research Questionnaire

about Evolving and Shaping of Dominant Design of Electronic Bicycle.

- 1) How long do you ride your current bike? () Year(s) () month(s)
- 2) How many days a week do you ride your current bike? ()
- 3) What motivated you to ride your current bike?
- 4) Before current bike, do you have any other bike for riding?
 - Yes/No
 - If you have, what kind of bike was it?

Bicycle, ordinary wheel electric bicycle, big wheel electric bicycle, quick board, others ()

- 5) Would you like to paste a picture of your bike?

※ A gift would be given for thanks for your participating of this survey.

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The Collective Intelligence and Open Innovation

-Comparative analysis of automotive and Pharmaceuticals Industries of Korea

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1. Introduction

Neural networks based computer program AlphaGo were trained by a novel combination of supervised learning from human expert games, and reinforcement learning from games of self-game, and defended the human Go champion SaeDol Lee by 4 games to 1 (Silver et al., 2016). The neural learning process is similar to open innovation in that it motivates creativity by open new combination like the creativity of open innovation by collective intelligence of crowd innovation (Sternberg & Lubart, 1995; Yun, Won, & Park, 2016). Right now, the learning of knowledge is becoming distributive, that is, not located in any given place (and therefore not 'transferred' or 'transacted' per se) but rather consists of the networks of connections formed from experience and interactions with a knowing community as a collective intelligence (Downes, 2010). Science is also collective because it depends on and has tried to institutionalize the free and open exchange of information in that when scientists make an important new discovery or experimentally prove some hypothesis, they do not, in general, keep that information to themselves so that they alone can ponder its meaning and derive additional theories from it (Surowiecki, 2005, p. 168). And, U.S. federal government has successfully implemented open innovation concepts invented in the private sector to crowdsource solutions from previously untapped problems solvers and to leverage collective intelligence to tackle complex social and technical public management problems (Mergel & Desouza, 2013).

Is there any relation between collective intelligence and open innovation if then? So to say, if collective intelligence just not produce creative idea or invention, but also any firm to innovation inside-out, outside-in, or coupled way, collective intelligence or crowd innovation should be motivated from the invention or research and development(R&D) steps. So we set up the following research questions

Does collective intelligence (or crowd innovation) motivate open innovation?

Is there any difference in the relation between collective intelligence and open innovation according to industries?

2. Literature Review, Hypothesis, and Research Framework

2.1. Literature reviews and hypothesis

Collective intelligence can be broadly defined as a group of individuals doing things collectively that seem intelligent which includes 4 factors such as 1) Crowd as who; 2) Hierarchy (or management), money, love or glory as why ; 3) collaboration, contest, or collaboration as how-create; 4) group decision, or individual decisions

through market, or social network for how –decide (Lane, 2010; Malone, Laubacher, & Dellarocas, 2010). And, the use of internet platforms and Web 2.0 technologies allows for another form of participation, which is possible irrespective of opening hours, meeting places, jurisdictional boundaries, places of residence and physical presence, which is called as “crowd innovation” in public administration with broad participation in public service (Collm & Schedler, 2012). The emergence of Web-based tools has made it possible to experiment with a number of different mechanisms for tapping into the decision-making capabilities of the collective intelligence at a firm in the condition such as the balance between diversity and expertise, and the distinction between decentralized and distributed decision making (Bonabeau, 2009). According to a report on the results of an investigation about the “informal”, public-side communications that occurred in the aftermath of the April 16, 2007 Virginia Tech(VT) Shooting, collective intelligence can also operate well in disaster situation (Vieweg, Palen, Liu, Hughes, & Sutton, 2008).

In really field research, evidence for a collective intelligence factor in the performance of human groups was found in that collective intelligence is higher than average member intelligence and maximum member intelligence(Woolley, Chabris, Pentland, Hashmi, & Malone, 2010). On the other hand, Algorithms to develop a collective mental map was researched to implement collective intelligence on the web (Heylighen, 1999). Other research developed rating scales for collective intelligence in innovation communities to analyze effective idea rating and selection mechanism(Riedl, Blohm, Leimeister, & Krcmar, 2010). Another research introduced a crowd ideation system where experts monitor incoming ideas through a dashboard and offer high-level “inspirations” to guide ideation as a way to improve crowd innovation with real-time expert guidance (Chan, Dang, & Dow, 2016). According to the emerging science of how to design a “collective intelligence(COIN)”, a COIN is a large multi-agent system which has no centralized communication, and a provided world utility function that rates the possible histories of the full system (Wolpert & Tumer, 1999).

Hypothesis 1; Collective Intelligence increase the performance of firm.

According to literates, collective intelligence increase not just the performance of public service, risk treating, science, but also the performance of firm. So, many new researchers try to develop the collective intelligence SW systems.

In fact, if all knowledge is explicit, i.e., capable of being clearly stated, then we cannot know a problem or look of its solution (Simon, 1976). So to say, Polanyi’s thesis, “We can know more than we can tell” cannot be escaped (Polanyi, 2009). So collective intelligence can increase the open innovation effects because the crowd can treat tacit knowledge more effectively than others for example individual researcher if we accept open innovation has been a valuable concept for so many firms and in so many contexts (Huizingh, 2011). And a growing amount of scientific research is done in an open collaborative fashion, in projects sometimes referred to as “crowd science”, “citizen science”, or “networked science”, such as a large-scale collaborative project involving thousands of participants who advance our understanding of protein folding at an unprecedented speed, or the Galaxy Zoo project involving over 250,000 volunteers who help with the collection of astronomical data (Franzoni & Saueremann, 2014). Even though he effects of collective intelligence were tried such as a multi-criteria rating scale instead of market perdition, in the end, through market performance we can measure the directeffect of collective intelligence, or its indirect effects of the open innovation strategy of firm (Blohm, Riedl, Leimeister, & Krcmar, 2011).

Redundancy principle, and design for emergence principle are required for crowdsourcing collective intelligence to arrive at social value, or additional knowledge creation, these 2 conditions are core of open innovation (Buecheler, Sieg, Fuchslin, & Pfeifer, 2010; Yun, 2015). Crowdsourcing as a “collective intelligence system” characterized by three components: an organization that directly benefits from the work of the crowd, the crowd itself, and finally a platform able to link the two together and to provide a host for the activity throughout its lifecycle can motivate directly citizen participation, and indirectly open innovation for opportunities for planning or others (Seltzer & Mahmoudi, 2013). So, collective intelligence through crowdsourcing can enlarge

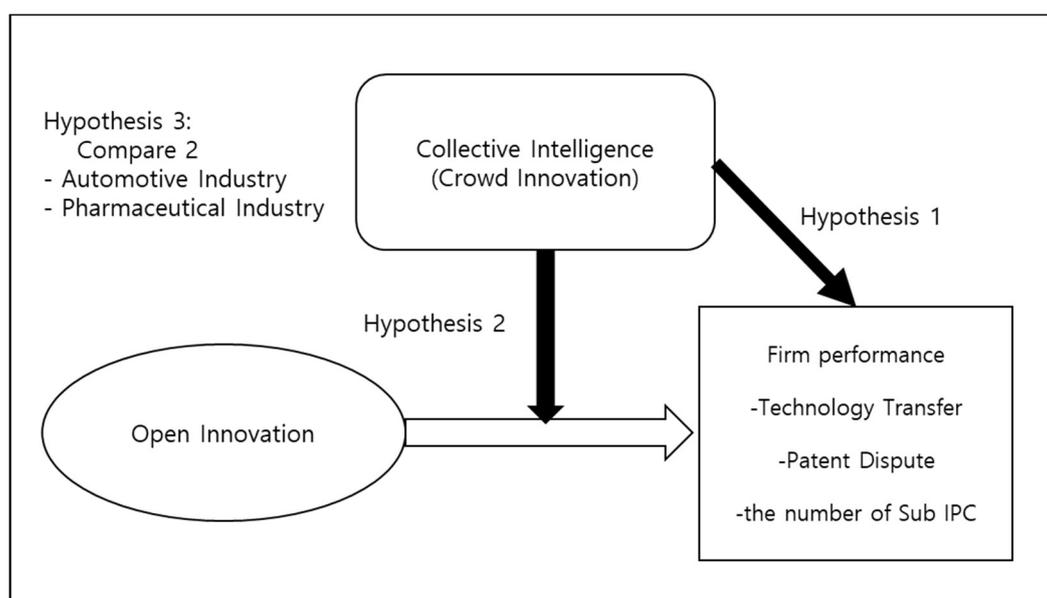
the open innovation effect in marketing, human resource management(HRM), or change management at firm level (Van de Vrande, Vanhaverbeke, & Gassmann, 2010). Permission-less innovation as the general policy default can motivate collective intelligence platforms directly and indirectly (Thierer, 2016).

If we possess all the relevant information, if we can start out from a given system of preferences, and if we command complete knowledge of available means, the problem which remains is purely one of logic which can be easily settled in the 4th industrial revolution because crowdsourcing works can operate best when an individual or company gives the crowd something it wants(Hayek, 1945; Howe, 2008; Lee et al., 2018). Based on portfolio theory, Renaissance Technologies developed crowd invest platform and arrived global success (H. Markowitz, 1952; H. M. Markowitz, 1991; McAfee & Brynjolfsson, 2017, p. 326). Crowd maybe can innovate without limits if it is possible in the permission-less innovation like Rob-hand case, and if we identify and remove barriers for crowd to entry and innovation with relying on existing legal solutions and the common law to solve problems even in the peer-to-peer electronic cash system (Nakamoto, 2008; Thierer, 2016).

Hypothesis 2: Collective Intelligence will motivate the effect of open innovation.

According to literature reviews, collective intelligence will motivate the effect of open innovation to the performance of firm. So we set up this is second hypothesis.

2.2. Research Framework



1) Independent variables

We have 2 independent variables such as collective intelligence, and open innovation as follows.

Collective Intelligence(CL) can be built up by the standardized multiple between the breadth of CL(BCL) (the ratio of 2 or more inventor having patents of the firm), and the depth of CL(DCL) (the average inventors of per patent of the firm).

Open Innovation(OI) can be measured by the standardized multiple between the breadth of OI(BOI) (the ratio of 2 or more applicants having patents of the firm), and the depth of OI(DOI) (the average applicants of per patent of the firm).

2) Dependent variables

We used 3 different dependent variables to measure the effect of open innovation, and collective intelligence fully as follows.

First, we use the average number of Sub IPC number of the firm as dependent variable. This is good to measure the increase of technology quality of the firm.

Second, we use the ratio of conflicted patents of the firm. Maybe the increase of the ratio of conflicted patents of the firm will points out the increase of the economic value of patents of the firm indirectly.

Third, we use the ratio of transferred patents of the firms, which means the commercialization of patents of the firm. So this mean the economic value of patents of the firm directly.

3) Control variable.

We control the number of patents as the control of the size of the firm, and the year of the firm.

4) Difference between automotive industry, and pharmaceutical industry.

In Korea, automotive industry has more than 40 years old maturing industry. But, the pharmaceutical industry of Korea is emerging stage until now. So, the open innovation and collective intelligence will give positive effect at the firm performance in the automotive industry. But they will not appear in the pharmaceutical industry of Korea.

Hypothesis 3. They will be different between the automotive industry, and the pharmaceutical industry in the motivating of collective intelligence to open innovation effects.

2.3. Research Scope, and method.

Based on the patents which were registered at Korea Patent office, we targeted automobile patents at B60 category, and pharmaceutical patents at A61K category, which were selected from patents registered during a 15-year period, from 2000 to 2014.

Table 1 Technical Statistical Analysis Patent Data Overview

Division	Automobile (B60)	Pharmaceutical(A61K)
Total number of patents of firm and individual	50,126	38,244
Number of patents of firm	40,336	25,772
Number of patent applicants including firms and individuals	10,978	14,679
Number of firms	3,844	5,265
Average patents per applicants including firms and individual	4.57	2.61
Average patents per firm	10.49	4.89

Among them, we deleted patents which were registered by individuals because we analyze the open

innovation, and collective intelligence of firms in this research.

Variables		Automotive industry			Pharmaceutic Industry		
		Mean	SD	Frequency	Mean	SD	Frequency
Dependent Variables	Ratio of Transferred Patent(RTP)	68.077	39.849	98	64.716	38.185	1075
	Ratio of Disputed Patents(RDP)	38.616	38.962	359	54.297	36.297	1432
	Average Number of Sub IPC (AN-SIPC)	1.691	.714	3844	1.848	.685	5265
Independent Variable	Open Innovation (OI) = zBOI*zDOI	.828	1.767	3844	.700	1.572	5265
Moderating Variable	Collective Intelligence (CL) = zBCL*zDCL	.700	.777	3844	.122	.587	5265
* BCL=Breadth of Collective Intelligence; DCL=Depth of Collective Intelligence; BOI=Breadth of Open Innovation; DOI=Depth of Open Innovation Sd= Standard deviation							

3. Automotive Industry Analysis

3.1. Correlation Analysis- Automotive industry with Transfer

Variable	Ratio of Transferred Patent(RTP)	Ratio of Disputed Patents(RDP)	Average Number of Sub IPC (AN-SIPC)	Collective Intelligence (CL) = zBCL*zDCL	Open Innovation (OI) = zBOI*zDOI
Ratio of Transferred Patent(RTP)	1				
Ratio of Disputed Patents(RDP)	.746**	1			
Average Number of Sub IPC (AN-SIPC)	-.038	.078	1		
Collective Intelligence (CL) = zBCL*zDCL	.114	.323**	.044**	1	
Open Innovation (OI) = zBOI*zDOI	.360**	.300**	-.028	.188**	1

Note. **. Correlation is significant at the 0.01 level (2-tailed).

1.1 Moderating Effects- Automotive industry on Average Number of Sub IPC (AN-SIPC) Moderating Effects- Automotive industry on Average Number of Sub IPC (AN-SIPC)

Dependent Variable	Average Number of Sub IPC (AN-SIPC) (β) ¹		
	Level 1	Level 2	Level 3

<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	-.028	-.038*	-.041*
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.052**	.045**
Interaction Term zOI*zCL			-.017

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

3.2.

3.3. Moderating Effects- Automotive industry on Ratio of Disputed Patents(RDP)

Dependent Variable	Ratio of Disputed Patents(RDP) (β) ¹		
	Level 1	Level 2	Level 3
<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	.300**	.215**	.253**
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.251**	.276**
Interaction Term zOI*zCL			-.096

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

3.4. Moderating Effects- Automotive industry on Ratio of Transferred Patent(RTP)

Dependent Variable	Ratio of Transferred Patent(RTP) (β) ¹		
	Level 1	Level 2	Level 3
<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	.360**	.360**	.408**
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.002	.037
Interaction Term zOI*zCL			-.107

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

4. Pharmaceuticals Industry Analysis

4.1. Correlation Analysis-Pharmaceutic industry with Transfer

Variable	Ratio of Transferred Patent(RTP)	Ratio of Disputed Patents(RDP)	Average Number of Sub IPC (AN-SIPC)	Collective Intelligence (CL) = zBCL*zDCL	Open Innovation (OI) = zBOI*zDOI
Ratio of Transferred Patent(RTP)	1				
Ratio of Disputed Patents(RDP)	.735**	1			
Average Number of Sub IPC (AN-SIPC)	-.055	-.028	1		

Collective Intelligence (CL) = zBCL*zDCL	.035	.039	.124**	1	
Open Innovation (OI) = zBOI*zDOI	.178**	.182**	.009	.146**	1

Note. **. Correlation is significant at the 0.01 level (2-tailed).

4.2. Moderating Effects- Pharmaceutical industry on Average Number of Sub IPC (AN-SIPC)

Dependent Variable	Average Number of Sub IPC (AN-SIPC) (β) ¹		
	Level 1	Level 2	Level 3
<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	.009	-.009	-.017
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.125**	.124**
Interaction Term zOI*zCL			-.016

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

4.3. Moderating Effects- Pharmaceutical industry on Ratio of Disputed Patents(RDP)

Dependent Variable	Ratio of Disputed Patents(RDP) (β) ¹		
	Level 1	Level 2	Level 3
<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	.182**	.180**	.180**
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.022	.022
Interaction Term zOI*zCL			.000

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

4.4. Moderating Effects- Pharmaceutical industry on Ratio of Transferred Patent(RTP)

Dependent Variable	Ratio of Transferred Patent(RTP) (β) ¹		
	Level 1	Level 2	Level 3
<i>Independent Variable</i> Open Innovation (OI) = zBOI*zDOI	.178**	.178**	.309**
<i>Moderate Variable</i> Collective Intelligence (CL) = zBCL*zDCL		.003	.004
Interaction Term zOI*zCL			-.181**

Note. β =standard coefficient, 2,3: natural log; **p<.01(2-tailed)

5. Discussion

5.1. Comparative Analysis of 2 Industries

5.2. Collective Intelligence as New Breakthrough

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6.

Is Social Innovation A Better Way To Do CSR?

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Abstract

Purpose/ Research Question

Research Question

—“Is social innovation a better way to do CSR?”

There are many ways to do CSR for companies. Social innovation becomes a new trend of it. Usually we think that CSR and social. Innovation is good and has positive effects on society, but perhaps they may have some negative effects. Implementing CSR by social innovation is emerging. But it is really promising for operating CSR? Or there are something we don't know that makes it not really a good way for CSR operating.

Research Objectives

— How companies do CSR by social innovation?

— What's the difference and results of social innovative CSR?

Keywords

— Social Innovation, CSR, Case Study, Qualitative, Social Enterprise,
Non-profit, Small or Medium Enterprise

Key Literature Reviews

"..... there is solid evidence in public discussion today that **Social Innovation will be key** for companies in the coming decade **to achieve the needed Corporate Sustainability** "(Osburg, 2013)

"Assuming the willingness of business to endure by meeting the challenges of the Triple Bottom Line, new innovative approaches are needed that go far beyond the traditional CSR concepts. **Social Innovation could be the best known approach today to achieve the needed Corporate Sustainability.**" (Osburg, 2013)

"CSR advocates spend a considerable amount of effortto align social responsibility with a business case, yet may be failing to alter the overall landscape. Often the **unintended consequences of good behavior lead to other secondary negative impacts**, too."(Doane & Abasta-Vilaplana, 2005)

"However, even self-evidently positive social innovation may not benefit all relevant stakeholders equally **create negative effects for some**. Moreover...may undermine important institutional norms whilst still delivering substantial benefits to target populations."(Nicholls, Simon & Gabriel, 2015)

Design/ Methodology/ Approach

Methodology

- Case study (Yin, 2017), collecting documentation, archival records and doing interviews Case selection
- Listed companies with CSR responsibility report and have experience in working with social enterprise or NPO for CSR projects
- SME which have implementing CSR independently or having experience in working with social enterprise or NPO for CSR projects
- Social enterprise or NPO which have cooperate with companies mentioned above for their CSR projects

Design/ Methodology/ Approach

Informants

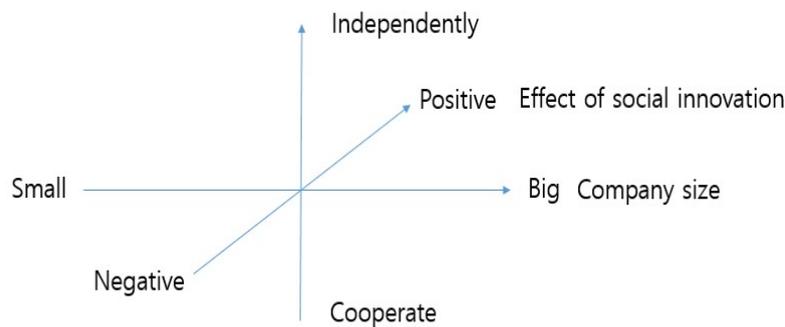
- Listed company : Managers or specialists of CSR department
- SME : CEO or managers or executors of CSR
- Social enterprise, NPO : CEO or managers or executors of the CSR corporation case

Number

- 5-6 companies
- 3 social enterprise or NPO
- 30 people totally

(Expected) Findings/Results

We expect that we can build a framework to analysis under which conditions and circumstances (company size, cooperate with other organizations or doing independently), social innovation can be applied well to create greater social benefits and also positive effects for the company.



Research limitations/ Implications

Research limitations

- For large company examples, this research only focus on listed companies with CSR reports. Future researchers can explore more of the other big companies.

Implications

- For governments that want to promote social enterprise and company cooperation, this research can provide them with a better reference for planning the cooperation projects and policies.
- For companies, this research can help them find the implementation method that is more suitable for their CSR according to their own conditions.
- For social enterprise or NPO, this research provides insight into the way they plan and design to work with the company

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7.

Understanding the Post-entry of Chinese Firms' ODI: Perspective of Springboard

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Abstract

Purpose/ Research Question:

Internationalization is not a new phenomenon, however, when it comes to multinational enterprises (MNEs) from emerging markets, there are still a lot of issues about their internationalization needed to be explored and explained (Deng, 2012).

Most of existing researches are focusing on antecedents and firm strategy of Chinese firms' internationalization, like motive, entry mode, location choice, ownership structure, and rationale of Chinese firms' outward direct investment (ODI) (e.g. Cui & Jiang, 2012; Deng, 2009; Xie, 2014; Yao, Arrowsmith, & Thorn, 2016). However, comparing with large body of pre-entry of Chinese ODI, little

attention is paid to the post-entry of Chinese ODI, like process, operation and performance, referring to those efforts to better understand corporate internal resources and capabilities and external institutional environments related to effective implementation of the internationalization of Chinese firms (Deng, 2009).

Therefore, this paper is focusing on the post-entry of Chinese firms' ODI, and try to explore, after establishing their overseas subsidiaries, through greenfield or cross-boarder M&A, how do Chinese firms improve their own innovation capability.

Key Literature Reviews (About 3~5 papers):

A huge raft of existing researches focus on multinational enterprises from developed countries set the R&D centers in developing countries (Patra and Krishna, 2015), and cooperate with firms from developing countries to enter the developing markets (Shao and Shi, 2018). In this process, firms from developing countries do learn knowledge from their partners or acquire the spillovers. However, this learning style is not enough for firms from emerging economics. They are going out to acquire the knowledge more directly. Wu et al., (2018) research on the effect of OFDI's entry mode on the innovation capability's improvement for Chinese firms, and they find the international breadth of firms and economic stability and investment protection of the host country significantly promote firms' innovation performance.

Based on five cases, Minin et al., (2012) researches on how Chinese firms establish R&D center in Europe in order to acquire the advanced technology, they find Chinese R&D units tend to evolve from a pure motives of exploration of technology into one of technology exploitation in foreign locations.

The evolution of motives of Chinese firms' ODI provide my research a dimension to see whether the evolution of motives of ODI affect the management of overseas subsidiaries by headquarters.

Wang et al., (2014) proposed that foreign subsidiary autonomy is a strategic mechanism to overcome the EMNE's weaknesses in managing globally dispersed businesses and their home-country disadvantages after foreign entry. They conducted a survey including 240 Chinese MNEs.

Klossek et al., (2012) conduct a multiple case study to answer how entry mode choice impacts the strategies adopted by Chinese firms to cope with the specific institutional and competitive hurdles in Germany. And they find acquirers and greenfield investors came up with different ways to reduce their LOF in the German marketplace. This research indicates that entry mode can affect the following management.

Design/ Methodology/ Approach:

A multiple case study will be used in the research, four cases are chosen by the criteria of research. The

details of cases are presented in the table.

Company	Envision	GOLDWIND	XCMG	Hengli
Home country	China	China	China	China
Industry sector (ISIC code)	Manufacture of machinery and equipment (28)	Manufacture of machinery and equipment (28)	Manufacture of machinery and equipment (28)	Manufactur e of machinery and equipment (28)
Entry mode of the target OFDI	Green field	Green field	M&A	M&A
Host country of the target OFDI	Denmark	Denmark	Germany	Germany
The year of establishment of the first overseas subsidiary	2008	2007	2012	2012
The year of establishment of the focal subsidiary	2008	2016	2012	2015
Product	Turbine	Turbine	Hydraulic products	Machinery
Product innovativeness	High	High	Medium	Medium

(Expected) Findings/Results:

A multiple cases study will be conducted to answer how do Chinese firms manage their overseas subsidiaries. And based on springboard perspective, how do Chinese firms take advantage of their ODI and overseas subsidiaries to improve their innovation capability will be investigated.

The expected findings are the different ownership of Chinese firms will perform different way to manage their overseas subsidiaries. The different entry mode of ODI will also affect the way of managing Chinese

MNE's overseas subsidiaries. The interaction of supplier-customer, experience of internationalization, and human resource of internationalization will all play an important role in explaining post-entry of Chinese firms' ODI.

The outcomes will contribute to the further understanding of firms' ODI from emerging economics.

Research limitations/ Implications:

The research on the internationalization of Chinese firms (ICF) can provide firms from other emerging markets with valuable reference. Since the phenomenon of Chinese firms' internationalization draw attention from academia, lots of researches investigate on the antecedents of ICF (Deng, 2012). After near 20 years development, many Chinese firms have already been successfully internationalized and more are on the way of internationalization. Nevertheless, the researches on the process or operations and the outcome of Chinese firms' internationalization will also provide practices implication for Chinese firms and other firms from emerging economics.

The limitation of research will be the potential case study's limitation of statistic generalization.

Keywords: Chinese firms, ODI, Internationalization, Post-entry, Springboard, innovation capability

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8.

A Strategic Architecture of Sustainable System Development Education for Industry, Innovation, and Global Value Creation with SDGs

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Abstract

UNESCO has been promoting Education for Sustainable Development (ESD) since 1992. It led the UN Decade for ESD from 2005 to 2014 and is now spearheading its follow-up, the Global Action Programme (GAP) on ESD. The momentum for ESD has never been stronger. Global issues – such

as climate change – urgently require a shift in our lifestyles and a transformation of the way we think and act. To achieve this change, we need new skills, values and attitudes that lead to more sustainable societies. Education systems must respond to this pressing need by defining relevant learning objectives and learning contents, introducing pedagogies that empower learners, and urging their institutions to include sustainability principles in their management structures.

Embarking on the path of sustainable development will require a profound transformation of how we think and act. To create a more sustainable world and to engage with sustainability-related issues as described in the SDGs, individuals must become sustainability change-makers. They require the knowledge, skills, values and attitudes that empower them to contribute to sustainable development. Education, therefore, is crucial for the achievement of sustainable development. However, not all kinds of education support sustainable development. Education that promotes economic growth alone may well also lead to an increase in unsustainable consumption patterns. The now well-established approach of Education for Sustainable Development (ESD) empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society for present and future generations.

ESD aims at developing competencies that empower individuals to reflect on their own actions, taking into account their current and future social, cultural, economic and environmental impacts, from a local and a global perspective. Individuals should also be empowered to act in complex situations in a sustainable manner, which may require them to strike out in new directions; and to participate in socio-political processes, moving their societies towards sustainable development.

As societies around the world struggle to keep pace with the progress of technology and globalization, they encounter many new challenges. These include increasing complexity and uncertainty; more individualization and social diversity; expanding economic and cultural uniformity; degradation of the ecosystem services upon which they depend; and greater vulnerability and exposure to natural and technological hazards. A rapidly proliferating amount of information is available to them. All these conditions require creative and self-organized action because the complexity of the situation surpasses basic problem-solving processes that go strictly according to plan. People must learn to understand the complex world in which they live. They need to be able to collaborate, speak up and act for positive change (UNESCO, 2015). We can call these people “sustainability citizens” (Wals, 2015; Wals and Lenglet, 2016).

This paper proposes a strategic architecture of sustainable system development (SSD) education for improving knowledge capital, human capital, industrial innovation, capital formation, and global value with sustainable development goals (SDGs). SSD education aims to human capitals with the abilities to recognize and understand relationships; to analyse complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty. In addition, the ability to collectively develop and implement innovative actions are also enhanced with the implementation of SSD. To the industry and innovation capability, it requires ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive and equitable solution options that promote sustainable development, integrating the above-mentioned competences.

With the strategic architecture of SSD education and practice, diverse case studies for entrepreneurial innovation system development, social innovation system development, and green innovation system development were presented to demonstrate the reinforcing feedback system and sustainable system development for knowledge capital, human capital, localized capital formation, and global values.

Keywords: sustainability, open innovation, strategy, innovation, knowledge ecosystem, systems thinking, policy.

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Collaborative Green Business Ecosystem and Strategic Development with Open Innovation Platform

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Abstract

In the green economy and globally competitive environment, continuous and open business model innovations with shared value have become a critical strategy for enterprises to develop competitiveness and market potential. Open business model innovations comprising the values of the social, environmental, and sustainable development have been highlighted as a new generation business model and opportunity in recent years. To this vision, the strategic thinking of “Creating Shared Value” (CSV) has been proposed that encourages enterprises to re-define the concept of products, markets, production value chain and local clustering development and the green industry.

To investigate the green industry, this research project takes a 70 billion NTD annually paper printing and publishing industry as the research object. Empirical data and in-depth interviews with industry experts will be adopted to explore the sustainability-oriented open business model innovation and market development strategy for international strategic alliances of green supply chain. Even though the green consumption and UPM green paper product innovation have been a global trend in the international community (UPM annual output already reached 10 billion euros), Taiwanese market and the grand China are still in the early stages of development and thus worthwhile for business research.

In order to enhance company’s strategic planning capability and business performance, this research project aims to combine the theory of open innovation, business model development, management sciences and System Dynamics methodology to develop a Strategic Decision Support System for Open Business Innovations (SDSS). Through computer simulation technique, the proposed SDSS will help enterprises to increase the dynamic planning capabilities, business strategy performance and create added value. This research project will help to analyze the open business strategies for the green industry and market development. The analysis of the customer base, open innovation strategy, market development strategies, operating cost, business performance assessment strategies could be performed by computer simulation. The quality of decision-making for industrial operations could be enhanced and the model could be further applied to China and international market.

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10.

Patent Risk Evaluation in International Trade Based on the Analytic Hierarchy Process and Entropy Method

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Abstract

Purpose/ Research Question: The main purpose of this study is to conduct a holistic evaluation on patent risk factors in the international trade process. Assessment and precaution of patent risks in international trade is of great significance for enterprises to reduce losses on patent infringement in the international trade. On the one hand, it is helpful for enterprises to prepare the potential risk in advance, so as to take preventive measures and countermeasures as soon as possible. On the other hand, it can indicate the specific approaches addressing the risk problems fundamentally. In fact, the patent risk is derived from the institutional difference and deficiency of patent protection, thus cooperation among developed countries and developing countries should be promoted to establish a more stable and orderly international trade system.

Key Literature Reviews (About 3~5 papers): There is no uniform definition for patent risk, and the concept of this terminology is also unclear. The existing literature generally describes this concept in perspective of legal risk, trade balance or project management. Failure of innovation, trade losses, infringing patent rights or patent rights infringed can all be regarded as the species of patent risk. At the level of Cross-border Trade, the most obvious patent risk in international trade is that the infringing products cannot be transited especially in the developed countries which have severe patent protection. For instance, the Section 337 in the US is one of the remedy approaches for patent infringement, and enterprises from specific countries that have weak patent protection or goods related to specific industrial field are probable to be investigated by the international trade commission (ITC) of the US (Lee et al., 2014). Conversely, in developing countries like India and Brazil, the patent law is lax compared with developed countries and inventions are hard to protect (Milstien et al., 2007). At the level of Multinational Corporation, the patent risk turns out as the disputes on patent rights, which often occur in some business activities, such as patent license, technology transfer, enterprise merger and acquisition. The conflict of patent lawsuit between Apple and Samsung in IT field is a famous case that have far-reaching influence on not only the two giant corporations but also other companies in the IT industry (Lee, 2012). And the possible result of lawsuit may be huge license fees (Lee et al., 2018).

Design/ Methodology/ Approach: For the issue of patent risk evaluation, enterprises need the information on what the risk is and which kinds of risk are more important. At the strategy planning level of enterprise, all risk factors should be fully considered. However, at the management decision level of enterprise, the risk factors that play major roles should be prioritized. The difficulty of the issue relies on how to accurately describe the risk factors. Realistically, there is no sufficient and structured quantitative data for evaluating patent risk directly, only few cases that are relevant. Through analyzing these case this paper extracts the main risk factors, and then carry out the further evaluation which supported by experts' opinions. The experts can make up for simplicity of case analysis. The judgement of experts will induce the priority sequence of risk factors (Saaty, 2008). And the Entropy Method can make the weight more objectively (Li et al., 2014). Thus, with the method applied in this study, the research framework is designed as follows: (1) Establish a hierarchy evaluation model; (2) Constructing judgement matrix; (3) Consistency Test; (4) Weight priority by entropy value.

(Expected) Findings/Results: Patent risk prevention is one of the important ways to enhance the enterprise's core competitiveness in international trade, and it is also an unavoidable problem especially for the enterprises that plan to enter the international market at the first time. Based on the AHP method and the Entropy method, this paper evaluates the essential patent risk factors which are compared in the context of international trade. Further, according to the analysis results, the synthesis weight values indicate the priority sequence of patent risk factors, which can guide the decision makers of enterprises to generate corresponding strategy.

Research limitations/ Implications: Although the main contribution of this paper is analyzing the priority of patent risk factors, there are some limitations in this study and we look forward to make up them in the following research. Generally, this paper just analyzed the external characteristics without focusing on the inner mechanism of patent risk formation. Therefore, in the future study, we plan to further explore the determinants of some specific patent risks, such as patent imitation risk, patent infringement risk or patent litigation risk. In these kinds of risk scenario, the relationships among the risk factors can be described in a deeper level by empirical study design, which we expect to be applied in the implementation of international trade policy for more effective patent protection.

Keywords: Patent Risk, Analytic Hierarchy Process, Entropy Method, International Trade

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• **OPPORTUNITIES PRESENTED BY CRISIS : THE UPGRADING
OF CHINA PHOTOVOLTAIC**

JIN JUN

Abstract

- Chinese PV firms were adversely affected by international trade conflicts, including anti-dumping and anti-subsidy, and the loss of policy preference. The development of China's photovoltaic industry has become a problem that cannot be ignored. Meanwhile, how to realize the goal of upgrading and catch up through internationalization is a strategic problem faced by many manufacturers in emerging countries. This paper examines what resources a firm needs and which approach a firm should take when upgrading along the global value chain based on an in-depth analysis of Company S. Research on the internationalization of Company S indicates that due to the firm's internal market, vertical diversity along the global value chain could be viewed as an international upgrading process. The case suggests that complementary capabilities and markets are the fundamental basis for upgrading. In addition, the internal market mechanism makes it possible to sustain the upgrading process without conflicts between subsidiaries. Moreover, synergies will develop through interactions with subsidiaries owing to complementary capabilities and the internal market. This study additionally provides suggestions regarding upgrading along the global value chain for multinational companies from emerging countries and contributions in aspect of internationalization strategy of SMEs from emerging economies and internationalization for upgrading along the global value chain

Keywords: Photovoltaic, upgrading, internationalization, global value chain, China.

INTRODUCTION

Since the end of the 20th century, the new energy source such as solar energy is thought as a solution of the challenge from the shortage of traditional fuel, with the property of environment friendly (Han, 2012; Dale and Benson, 2013). The solar photovoltaic industry has become the priority in many countries. Under the support of Chinese government, as an industry for the low-carbon transition, the Chinese solar photovoltaic (PV) industry has become the country with the largest capacity of PV products in the world since 1990s (Zhang et al., 2014; Iizuka, 2015).

After rapid growth in the 1990s and 2000s (Zhang, Andrews-Speed, & Ji, 2014; Iizuka, 2015), Chinese PV firms were adversely affected by international trade conflicts, including anti-dumping and anti-subsidy investigations of Chinese photovoltaic products by the United States (US) and European Union (EU) at the end of 2011 (Shi & Bai, 2012; Sun, Zhi, Wang, Yao, & Su, 2014). A growing number of researchers have recognized the importance of technological improvements in the global value chain (GVC) (Grau, Huo, & Neuhoff, 2012; Park, 2017). Industrial transformation and upgrading is one method of addressing this problem. Some studies suggest that the export-oriented technological upgrading of Chinese firms contributes to the success of Chinese firms in foreign markets (Fu, Pietrobelli, & Soete, 2011). Nevertheless, it is not easy for many Chinese export manufacturers to upgrade because they provide components to foreign firms and foreign markets. How, then, can a firm from an emerging country, like China, upgrade along the global value chain? This is a question that requires further research. Nevertheless, if there were no large underdeveloped Chinese local market and no support policies from the Chinese government for the development of Chinese local PV market, how could the Chinese PV companies address the international trade conflict? It is also a problem faced by many other Chinese industries.

This paper asks the research question, "How can a firm realize the goal of industrial upgrading through internationalization?"—a question that can be divided into two sub-questions: 'What

resources does a firm need to in the process of upgrading?” and “What approach should a firm take in seeking to upgrade?” We use the case of the internationalization of Company S to answer our research questions based on an in-depth analysis of the company. The results of our research will contribute to both the theory and practice of industrial upgrading and internationalization of companies from emerging countries in the global value chain.

Through the research of this paper, there are the following contributions (1) firm should set up new strategy for the market expansion, not as same as competitors (Chinese PV for Chinese markets and later for the markets in developing countries), and achieve first mover advantage (other PV had the similar strategy later); (2) internationalisation strategy of SMEs from emerging economies; (3) internationalisation for upgrading along the global value chain

The paper is organized in six sections. Following the introduction, Section Two reviews the literature on the resource-based view, international strategy internationalization, catching up / upgrading, and the solar industry and PV firms. Section Three discusses the research methodology and research process used in the study. Section Four describes the development of Company S. Section Five analyzes and discusses the fundamental resources and capabilities of Company S, the approaches to upgrading along the global value chain followed by Company S, and the evolution of Company S during the upgrading process. The paper closes with conclusions and suggestions regarding upgrading strategies.

LITERATURE REVIEW

The resource-based view, international strategy, international process, 3L in the internationalisation, catching up / upgrading

As one of the most prominent and powerful theoretical approaches in the strategic management field (Newbert, 2007; Barney, Wright, & Ketchen, 2011), the resource-based view (RBV) is prevalent in research on international business (Peng, 2001; Westhead, Wright, & Ucbasaran, 2001) and commonly used as a theoretical basis for research on emerging market multinational enterprises (Luo & Zhang, 2016) and diversification (Wan, Hoskisson, Short, & Yiu, 2011). The resource-based view has its basis in the recognition that resources are an important driver of firms' decisions about how to position themselves in the market and the value chain (e.g., Young, Smith, Grimm, & Simon, 2000). In the research on innovation and dynamic capabilities, RBV is also used to emphasize the importance of knowledge and combinative capabilities as a resource (Kogut & Zander, 1992), dynamic capabilities as a competitive advantage in sustaining the development of firms (Teece, Pisano, & Shuen, 1997; Almor, & Hashai, 2004), and innovation capabilities are positively related to innovation performance (Yusr, 2016), and so on. Thus, RBV is among the theoretical perspectives employed in this analysis.

With the constant progress of globalization and internationalization, China now is experiencing the period of transitioning from primarily a center of low-cost export manufacturing to a large and rapidly growing domestic market (Weil, 2013). At present, the study of catching up mainly focus on the early stage (how to acquire enough knowledge to access the market, e.g. Shao & Shi, 2018), while for the later stage - the process of transition is still in its infancy with poor related literature and relatively discrete (Guo et al., 2016).

PV industry and Chinese PV firms

The development of the PV industry depends on a global supply/value chain (De La Tour, Glachant, & Ménière, 2011; Platzer, 2012). The low value-added stage of the value chain in the PV industry is silico, while the high value-added stage in the value chain is electricity generation (De

La Tour et al., 2011). Because a complex PV supply/value chain involves several manufacturing processes, various distribution channels, different regional markets, and so on (De La Tour et al., 2011), every stage in the value chain is highly competitive, making it hard for PV firms to move along the GVC. In terms of the global value chain model, most Chinese PV firms are in the low value-added stage, as they are providers of PV components, such as cells (Zhang, Zhao, Andrews-Speed, & He, 2013).

Lund (2009) proposes a typical production and market growth strategy for new energy technologies from the local to the global market and from local to global production. The market development of Chinese PV firms shows a significant difference from the start-up phase (Lund, 2009). In the period from 2004 to early 2011, the dominant market for Chinese PV products was not the home market (the Chinese market) but the foreign market because of the relatively low barriers to entry to global markets. This suggests that Lund's model (Lund, 2009) does not match the development of Chinese PV firms well. What has been the international growth path of Chinese PV firms? This is a question in need of further research.

In addition, to maintain sustainable development, the need for technological improvement and cost reduction along the value chain is urgent (Grau et al., 2012). Nevertheless, how to shift from the low value-added stage to the high value-added stage is a hard task for Chinese PV firms and a question still being studied.

RESEARCH METHODS

The case study method can be used to answer the research questions of studies based on the principles of engagement with practice (Yin, 2009) and build new theories in a more accurate and robust way (Eisenhardt, 1989). In addition, the case study method and other qualitative research methods are critical to capturing phenomena, explaining the uniqueness of management, exploring comprehensive insights and developing context-specific theories of emerging markets (Tsui, 2006), such as China, owing to the variety of philosophies, theories and approaches in business and management between emerging markets and developed ones (Barkema, Chen, George, Luo, & Tsui, 2015). Therefore, the present study adopts the case study method to better understand and explore the mechanism and strategies involved in upgrading along the global value chain for B2B manufacturing firms in an emerging industry and from an emerging market.

A longitudinal case study can provide a more comprehensive understanding of the background of a given case and reveal how the study object changes over time. A single case study can be used to explore the typical case in a representative sense, with the conclusions helping to deepen our understanding of similar events or things (Yin, 2009).

As noted in the literature review section, the PV industry is a typical B2B industry, occupying a clear stage in the value chain. In addition, the internationalization process of the PV industry in China has certain distinguishing characteristics. However, as that topic is under research, we choose a firm in the Chinese PV industry, Company S, for our case study to analyze the approach that a B2B manufacturing firm takes to upgrading along the global value chain.

We choose Company S as our case mainly because of its typicality. First, Company S already has a history of more than 16 years in the PV industry. As a solar wafer and modular producer, Company S sells its products to firms, not to individual consumers. Its product is not the terminal product in the industrial value chain but rather the second to fourth stage of the value chain. Company S exports a large percentage of its products to international markets. The development of Company S was strong both before and after the industrial crisis of 2012. Second, Company S has undergone a notable upgrade to the high-end of the value chain during its history. When facing

the Chinese PV manufacturing crisis, Company S established an engineering firm in Germany to build and operate solar energy power stations that use silicon wafers and systems produced by Company S's Chinese factory. The function of the engineering firm in Germany is to install systems, equipment, and other items in an electricity generation system (a solar energy power station), completing the final two stages of the value chain. Third, most purchasers of PV products are not individuals but representatives of the PV industry. Chinese firms export components involved in PV electricity generation, such as wafers, chips, systems, and so on, to firms in other countries. It is impossible to export directly to individual customers in the PV industry, making it a typical B2B industry. Thus, the developmental trajectory of Company S is an ideal example that can be used to illustrate strategies and approaches of firms from developing countries in upgrading along the global value chain. Our study thereby contributes to research on the internationalization of firms from developing countries. Company S is an example of a firm that has an engineering company in Germany (Company S – Germany) and a factory in China (Company S – Shaoxing). The Company S Group owns Company S in the PV industry and other firms in the chemical fiber industry.

Interviews and field visits were used to collect data for this research. In addition, second-hand data and company data were collected. We conducted two formal interviews with several senior management team members of Company S - Shaoxing, the Company S Group and Company S - Germany in 2014 and 2015. In the summer of 2014, we visited Company S and interviewed the board secretary and the co-founder of the Company S Group as well as the general manager of Company S – Shaoxing. Each interview lasted more than 1.5 hours. To collect first-hand information about Company S – Germany, one of the authors visited the solar energy power station in Lolland, Denmark with all members of Company S – Germany in December 2015. During the one and a-half day field trip, we interviewed all members of Company S - Germany, including the CEO (the founder of Company S – Germany), key engineers, financial personnel, and staff in charge of purchasing and logistics. Information provided by the CEO was verified by information from staff members, and vice versa. The CEO of Company S – Germany was interviewed several times. In addition, we interviewed an investment firm in Denmark that is one of the investors in the solar energy project in Lolland and a long-term partner of Company S – Germany—an interview that lasted approximately 2 hours. Information obtained from this investment firm was used to corroborate information obtained from Company S - Germany regarding the complicated process of carrying out a PV electricity generation project. Moreover, several informal communications with the board secretary of Company S Group took place in 2016 and 2017 to corroborate the information obtained from Company S – Germany about the running of the company and cooperation between the two subsidiaries. Additionally, through these communications, we updated our information about the co-development of the two subsidiaries in 2016 and 2017, following our earlier interviews. Public information from websites and companies' introduction documents were also used as background information and to triangulate the data.

The collected data were recorded and analyzed according to our analytical framework and the value chain, with a focus on resources and capabilities, the trigger factor in the establishment of Company S - Germany, the approach to upgrading, the development of synergies following the establishment of Company S - Germany, the internationalization process of Company S, and so on.

CASE DESCRIPTION

Founded in Shaoxing in Zhejiang Province of China in 2005, Company S has rapidly expanded its production and gained a considerable market share by producing silicon chips, solar cells,

crystalline PV-modules and photovoltaic constructions. Company S's factory, with more than 1,500 highly qualified employees, is based in Shaoxing and is called Company S – Shaoxing, as mentioned above. The general manager of Company S -Shaoxing has approximately 20 years of work and research experience in the PV industry. After decades of development, the conversion efficiency of the photoelectric cells of their products has increased, and the annual production capacity of Company S reached 600 MW in 2013. As with other Chinese PV manufacturers, Company S produced and exported safer silicon products to foreign markets before 2013. Foreign markets, especially the European market, contribute heavily to the revenue of Company S, providing 70% to 100% of company revenue before 2013. With the growth of PV electricity generation in Europe, Company S has become one of the largest photovoltaic manufacturers in China. In 2010, Company S went public in Shenzhen.

However, the European market was turbulent, with international trade conflicts between China and Europe. As with other Chinese manufacturers of wafer silicon chips and cells, Company S faced international trade conflicts related to anti-dumping with America and Europe at the end of 2011. Company S - Shaoxing suffered severe losses in 2012, as did other Chinese PV companies, because of the crisis in the international market and the immaturity of the domestic Chinese market.

Company S was planning to establish a firm in Europe focused on PV electricity generation projects that use PV components produced by Company S – Shaoxing. However, in Europe, completing a PV electricity generation project from project planning to PV electricity generation operations is an extremely complicated process. It includes not only project bidding, the leasing of land, station design, choosing a PV-module, purchasing, implementation of the project, tax accounting, sales, station operations and service maintenance but also fundraising for the project. In addition, each PV electricity generation project must be run as an independent firm, requiring all the procedures normally undertaken by start-ups in Europe. For those unfamiliar with the regulations and rules applied to PV electricity generation projects in Europe, as was the case with Company S and many other Chinese PV firms, it would be impossible for them to do it themselves. In addition, Company S did not have the ability and strength to acquire a European firm involved in solar power. Moreover, these capabilities take time to acquire and develop, so, to set up an engineering firm, the Company S Group had to find partners with strong industrial knowledge and capabilities. Therefore, in 2011, Company S partnered with a Chinese expert and her colleagues in the PV industry in Germany, inviting her to set up its sole-invested firm in Germany (Company S – Germany) as an engineering firm that performs all operations related to PV electricity generation, from design to operations and maintenance of PV electricity generation, using products provided by Company S - Shaoxing. The CEO of Company S – Germany is a friend of the boss of Company S, a previous customer of Company S in Germany and who has substantial experience in the PV industry in Europe. In addition, key employees of Company S - Germany are qualified engineers with significant PV industrial experience. Company S – Germany is independent of the sales office of Company S in Europe.

Since then, Company S - Germany and Company S - Shaoxing have cooperated to expand their business in the European market for PV electricity generation and sustain the production and exports of Company S – Shaoxing. Thus, through cooperation with foreign partners in Europe and based on the industrial expertise of employees and the manufacturing base of Company S - Shaoxing, Company S – Germany has grown in the European market. Company S – Germany has now completed PV plant projects in Germany, Italy, Spain, Romania, and Denmark. Most importantly, Company S has recovered from the industrial crisis. Company S – Shaoxing has not only improved its production capacity, which reached 600 MW in 2013 but also developed its engineering capacity based on domestic projects and cooperation with Company S – Germany. For

example, with the technical support of Company S – Germany, Company S - Shaoxing has carried out construction of a PV electricity generation facility in Hainan in China, with installed capacity of 20 MW. With such cooperation, Company S has expanded its overseas market from Europe to South America and Africa. For instance, Company S – Shaoxing and Company S – Germany cooperated in a bid for a PV electricity generation project in Mauritius.

CASE ANALYSIS

A. The complementary capability for upgrading and co-development

Based on the resource-based view, we suggest that complementary capabilities between Company S – Shaoxing and Company S – Germany is the basic condition for the implementation of upgradation along the global value chain. Without the respective capabilities of Company S – Shaoxing and Company S - Germany, the international upgradation strategy would have been unwarranted.

B. The trigger factor of upgrading

Lee, Song, and Kwak (2015) suggest that the crisis pushed firms to create a new trajectory of the global value chain.

C. The approach to upgrading

The internal market relationship between Company S – Germany and Company S – Shaoxing suggests that the establishment of an internal market can be a mechanism for firms to upgrade along the global value chain.

D. Internationalization at the high value-added stage of the global value chain

Based on the key activities and location, internationalization along the global value chain of Company S (including Company S – Shaoxing and Company S – Germany) can be divided into three stages

The key findings of case: (1) specific internationalization process: set up a service company along the global value chain, not acquisition, not sales; (2) co-create the market and tech improvement in the process; (3) dependent and in-dependent between two companies (internal market)

CONCLUSIONS

The above in-depth analysis of the development of Company S after 2011 reveals a possible approach to upgradation and the resources needed for upgradation in the PV industry. Based on this case, this research proposes an international upgradation process for firms in the PV industry, a process that includes three stages: stage 1 – exportation; stage 2 – international upgradation; and stage 3 – global expansion. In this process, firms can upgrade along the global value chain without becoming involved in price wars, establishing local factories overseas, or engaging in overseas R&D.

The co-evolutionary development of subsidiaries of Company S in Shaoxing and Germany and the international upgrading process indicate the importance of the complementary resources and capabilities of the two subsidiaries as the basic conditions for the implementation of an upgrading strategy. In addition, the internal market is a useful and effective means of enhancing interaction and cooperation between international subsidiaries of firms. Without complementary resources and capabilities—the production capabilities to provide high-quality wafers and other products of Company S – Shaoxing and the engineering and marketing capabilities to build and operate PV

solar electricity generation facilities of Company S – Germany—it would be impossible to set up the internal linkage and internal market between the low value-added activities and the high value-added activities in the global value chain to complete the internationalization of a firm. On the other hand, the co-evolution of Company S – Shaoxing and Company S - Germany suggests that Chinese firms should not give up manufacturing capabilities and advantages, even those at the low end of the value chain, as they provide solid support to high-end value activities, enhancing their comparative advantages.

Company S's recovery from the industrial crisis - the anti-dumping international trade conflict – shows that upgrading and transition could be a way of maintaining the sustainable development of firms (Grau et al., 2012) and addressing business crises, in addition to expanding the market to other regions, such as the Chinese PV market following the industrial crisis after 2011. The research also illustrates that upgradation not only solves economic performance problems in overseas markets but also enables expansion of the market for PV solar electricity generation into the Chinese mainland and other countries.

By not focusing on expansion of the production base overseas to maintain a certain position in foreign markets for PV products, such as PV modelers, the case of Company S also illustrates the advantages of establishing a subsidiary at the high value-added stage of the value chain as a capability and market complement. Thus, the specific international upgradation process of firms proposed in this research emphasizes upgrading and improvements in synergy between high- and low value-added stages of the global value chain, which differs from the typical international production and market growth strategy for new energy technologies (Lund, 2009). At the same time, by focusing on the specific internationalization process of establishing a subsidiary corporation in a target market—which is not a low-cost strategy or the establishment of an overseas factory or an M&A or overseas R&D—Company S grows and achieves industrial upgrading. The international strategy of Company S requires further research in the future.

The development of Company S reveals that a firm should take a crisis as a trigger to upgrade and transition when the firm can access or owns complementary capabilities. For instance, the crisis in the Chinese PV industry at the end of 2011 played a role in triggering Company S's upgradation in the global value chain and in its transition. It confirms the finding of Lee and his colleagues regarding the time needed to create a new trajectory of industrial development (Lee et al., 2015). The unique internationalization pattern in this case can inspire our thinking in other fields as well. This research is based on one case in China, which limits the generalizability of the findings. Therefore, cases of other companies, for example, the Chinese and US subsidiaries of the Wanxiang Group in the auto components industry, should be studied, and other research methods (such as quantitative methods) should be employed to explore and test the findings of this paper.

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An analysis of converged core capacity affecting team creativity of industrial workers

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Abstract

Purpose/ Research Question:

The purpose of this study is to analyze the effect of core competencies of industrial workers on team creativity in order to establish the direction of core competency education of universities as the 4th industrial revolution era arrives. In addition, this study is to minimize the mismatch between university education and industry needs and to provide basic data for linkage education. Specific research issues to achieve these objectives are as follows:

First, what is the level of team creativity and convergence of industry workers?

Second, what is the impact of convergence of industry workers on team creativity?

Key Literature Reviews:

In the era of the 4th industrial revolution, the future education emphasizes core capabilities. In particular, the creativity talent is required as a talent award for the future society, which combines knowledge and application to solve various problems. Gary Hamel, professor of London Business School, referred to team creativity as one of the virtues needed for a future society to work with and collaborate with people of different majors in various fields [1].

As competition intensifies between countries and uncertainty about the future increases, the cultivation of human resources that foster creative convergence is an important task of university education [2]. The creativity is also the most needed skills across business and the industry [3], [4]. In this context, the research on various aspects of creative competence has been carried out through revision of the curriculum, teaching & learning strategies, and teacher training [5], [6], and [7].

Thus, it is necessary for one who has developed the capacity for convergence of creativity to show a

methodical look through the education according to the needs of the times. Such efforts and demands are not only sensitive to the environmental changes but also emphasize loyalty and immersion in the organization in order to maximize corporate profits. In particular, through the team-style organizational restructuring in a hierarchical structure based on individual capabilities, many companies have generated profits and made progress in the corporate sector. With this development, the importance of team creativity has become important in the industry organizations to the create creative ideas and solve the problems among team members through joint efforts [8].

A study by Woodman, Sawyer, and Griffin (1993) showed that the problem-solving strategies and cohesiveness of team members affect team creativity. Converged thinking has also shown that people are not afraid of the process of nonlinear thinking than traditional thinking [10]. This integrated thinking. Yin can be seen as the team's thinking activities that embrace different levels of knowledge and information, and the balanced thinking of intuition and logic creates team creativity. As such, the research has been conducted based on the various views and perspectives on the members of the group regarding the calculation of team creativity. However, there is insufficient research on the ability of industrial workers' convergence core competencies to affect team creativity. Thus, it is necessary to study what factors among team members' convergence core competencies affect team creativity.

Methodology:

Subject

This study examines the impact of convergent core competencies of industry workers on team creativity. The survey was distributed to industry workers for two weeks from September 4 to September 28, in 2018, and the total of 104 people were analyzed, except for those, who are with many missing values.

Measuring tool

In this study, there are six questions asking about demographic characteristics and 24 questions asking about your current level of integrated core competency.

Table. 1. Measuring Tools Configuration

	Division	Number of questions	Cronbach' α	source
Demographic characteristics	Sex, age, career, education, workplace, job	6	-	
Fusion Core Competence	Creative Thinking, Critical Thinking, Understanding of Fusion Knowledge, Problem Solving, Communication, Cooperation, Use of Convergence Tools, Consideration, Responsibility	9	.903	Park, K. M(2014)
Team Creativity	Diversity (4), Leadership (8), Derivation of Idea (7), Autonomy (5)	24	.911	Choi, J. I & Kim, H.S(2015)

Data Analysis

In order to test this research problem, the collected data were analyzed using the PASW Statistics 18.0 program. The frequency and the percentage were calculated to identify the general characteristics of the subjects, and the Cronbach ' α ' coefficient was calculated to determine the internal consistency of the survey instruments. The minimum value, maximum value, average, and standard deviation were calculated to analyze the core competence and team creativity level of the industrial worker. In addition, one-way ANOVA (one-way ANOVA) was conducted to analyze the difference between the core competence and the team creativity according to the demographic characteristics of the subjects. After that, Scheffe was performed by post - test. Finally, we conducted a multiple regression analysis to analyze the effects of the core competencies of industrial workers on team creativity.

Results:

Fusion core competencies and team creativity level of industrial workers

The average (standard deviation) of 'creative thinking' was 3.34 (.915), and the average (standard deviation) of 'problem solving' among sub factors of convergence ability was 4.17 (.667), and the mean

(standard deviation) of 'care' was 3.86 (.875) among sub factors of convergence attitude ability, and 'problem solving' was the highest fusion core competence. In addition, the level of team creativity showed the highest level of 'leadership' (standard deviation) of 3.58 (.881), and the average (standard deviation) of 'idea extraction' was the lowest of 3.41 (.837).

The relationship between the core competency of the industrial worker and team creativity

The correlations between all variables showed significant correlation ($p < .001$), and sub - factors of convergence core competence showed a positive correlation with team creativity. In addition, the fusion core competence that showed the highest static correlation was creative thinking ($r = .417$, $p < .001$). This result can be predicted that the core competence of fusion which shows the highest correlation with team creativity is creative thinking ability.

In conclusion, we analyzed the effect of competency on the team creativity output based on core competencies of industrial workers. As a result, creative thinking and consideration of core competence of team members influenced team creativity. The results of this study are as follows. Kwon et al. (2018) conducted a survey of senior managers of Korean shipyard in the same context as emphasizing communication capacity based on consideration of characteristics of team members for organizational management and success.

Research limitations:

Despite the theoretical and empirical implications of this study, the limitations of the study are as follows. First, this study conducted questionnaires from various industrial workers in the study subjects. However, the distribution of research subjects was divided into management, office, profession, service, and sales. Therefore, further studies should be conducted on workers belonging to various industries and organizations.

Second, this study examines what factors among the core competencies of industrial workers affect team creativity, and neglects that the types and characteristics of teams can act as interference factors. Therefore, further research should be done on the general characteristics of the types and characteristics

of the team, not individual workers.

Keywords:

Industry, Converged Core Capability, Team Creativity

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13.

The Effect of Innovation Capabilities on Business Performance : Focused on IT and Business Service Companies

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Abstract

With the advent of new technologies from the Fourth Industrial revolution, the industries environment of Korea has been changing rapidly. As a result, the corporates in Korea have tried to enhance the level of their innovation activities to ensure the growth and development of their business performances and sustainability. Innovation activities which are investment on new technology adoption, technical and non-technical innovation factors and R&D activities play the critical role in the growth and development of the corporates in the varieties of industries. IT and business service industry, which is one of the most important industries in Korea, has been impacted by new technology invention, Blockchain, AI Bot, Big Data etc., so they try to adopt the new technologies as soon as possible to get the competencies to differentiate its services from other competitors, so they can survive in the rapidly changes business environment. The aim of our study empirically explores how the innovation activities have an effect on the business performance for Korea IT and business services sector of the corporates. To achieve this aim, we have examined the innovation activities and business performance of the 132 companies of large, Small and Medium companies in IT and business sector in Korea from 2009 to 2016. The study takes an empirical analysis with time series analysis on business performance from the perspective of employment rate and knowledge creation, as well as from a financial aspect and also multiple regression analysis. As analysis data, statistical data from Korea institute of patent information; Korea science and technology policy institute; Korea institute of S&T evaluation and planning; Bank of Korea; and also

multiple regression analysis is applied to our study for the fundamental analysis methodology. For Time series analysis, the Box-Jenkins method, applies autoregressive integrated moving average (ARIMA) is used.

The concept of innovation is so vast that it has been studied in a number of academic researchers, from management and the technology, and psychology to economics and also to sociology. The definition of Innovation can be differently described by scholars, but it is generally defined as contribution a new opportunity to the institution which adopts it as service, product, technology or other means of method. Since a new innovation occurs in an organization it is generally considered as a subjective and relative matter, not an absolute and objective fact. Since innovation is one of the important forms of organization, organization should understand how this innovation can be diffused better and fast in an organization and accepted by its members without any difficulties. This is a critical theoretical foundation for considering the innovation within an organization. Rogers suggested an innovation diffusion theory, and indicates to a case of communication among members within an organization through a communication channel with the portion of time. Refer to his explanation, innovation diffusion consists of four main attributes: innovation, time, communication channel, and organizational system.

Technological convergence from the 4th industrial revolution caused many innovations in recent years. Many organizations in IT industry try to redesign and compose their business process and collaboration strategy to adopt the innovation factors. Innovation factors in the organizations are the critical factors for the organization itself and also in the co-operation between organizations. Many studies analyzed the impact of innovation competence of the organization impact on the business performance.

Hypothesis 1 (H1). In the Korean IT and Business service industry, Innovation investment capability will promote business performance.

- (1-1) Innovation investment capability will promote employment rate index.
- (1-2) Innovation investment capability will promote business growth index
- (1-3) Innovation investment capability will promote knowledge productivity index.

Hypothesis 2 (H2). In the Korean IT and Business service industry, Innovation activities capability will promote business performance.

- (2-1) Innovation activities capability will promote employment rate index.
- (2-2) Innovation activities capability will promote business growth index
- (2-3) Innovation activities capability will promote knowledge productivity index.

Hypothesis 3 (H3). In the Korean IT and Business service industry, Innovation research capability will promote business performance.

- (3-1) Innovation research capability will promote employment rate index.
- (3-2) Innovation research capability will promote business growth index

(3-3) Innovation research capability will promote knowledge productivity index.

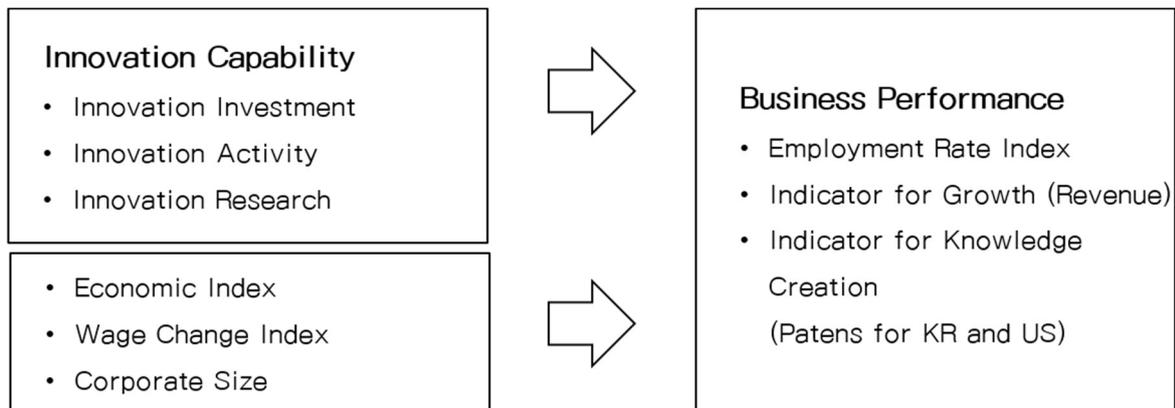


Figure 1. Research Framework

From a comprehensive perspective, our study analyzed the impact of innovation activities on the improvement of the social, financial and knowledge creation performance of the corporates in IT and Business service sector. Through the empirical analysis, the companies in IT and business sector have the significance of business benefits from the higher level of innovation capabilities in innovation investment, innovation activities and innovation research aspects. Our study statistically established the relations between innovation activities and business performance for IT and business service industry. First various other innovation factors needed to be analyzed in depth. A follow-up study should be conducted to analyze the various innovation factors in the industry. Second there is a need to analyze in depth for the relations of the innovation factors and firm’s financial performance in other industrial sectors, industrial differences should be analyzed.

Keywords: IT technology; Innovation; 4th industrial revolution; Blockchain; Business Performance;

Reference

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14.

What Determines Organizational Innovation in Public Sector?

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Abstract

Along with the growing interest in organizational innovation, a variety of studies have been conducted. Innovation is one of the key factors that determine the survival of an organization under the rapidly changing environment. Typically, an organization as an organism attempts new, internally innovative changes to hedge against potential threats from external environments, and success of such changes determines the survival of the organization. As for the importance of innovation for practitioners, research on innovation has been conducted (Burns & Stalker, 1961; Hage & Aiken, 1970).

The study of organizational innovation has a multidisciplinary approach, characterized by different approaches to academic discipline. While psychology focuses on the elite, the characteristics of the organization's member, and group or organizational conditions that stimulate innovation, economics is concerned with the impact of variables such as organizational size, market competition, internal and external resources and innovation on productivity and performance. In addition, technology field focuses

primarily on the production process and the impact of new technologies on existing technologies, and sociologists are interested in the organizational characteristics associated with accommodating innovation (Gopalakrishnan & Damanpour, 1997).

However, research into organizational innovation in the public sector remains a minority despite its need. The purpose of this study is to explore the determinants of organizational innovation in the public sector.

Research Question: To explore what determines organizational innovation in public sector

Key Literature Reviews

1, Innovation

Innovation is defined as creating or purchasing new devices, systems, policies, programs, processes, products, services, etc. Meta-analysis divides the dimensions and types of innovation into administrative and technological innovations, incremental and radical innovations, and indicates that the relationship between them and the organizational variables is different. Management innovation and innovation are one of the most generalized categories of innovation, mainly related to organizational structure and management processes related to administrative activities, and innovation is mainly related to products, services, and production process technologies related to products or processes(Damanpour, 1991).

2. Determinants

Pierce and Delbecq (1977) argues that structural components(differentiation, specialization, formulation), contextual elements(environmental uncertainty, organizational size, organizational history, interdependence), and personal characteristic(job satisfaction, performance, internal motivation) are the determinants of organizational innovation. Glynn (1996) suggests that personal characteristics, job characteristics, organizational characteristics. Daft (1982) divides variables that affect innovation into individual elements(major decision makers, transformers, HR, perceived performance elements), organizational elements(size and resources, organizational structures, etc.), environmental factors (market-related, customer/community elements, and other organizational elements).

2. Determinants(continued)

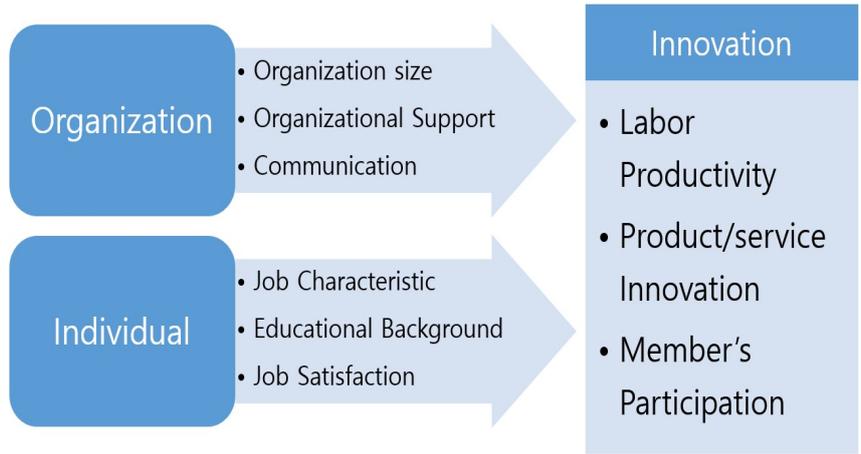
Organizational structure facilitates innovation by flexibility with less emphasis on rules and procedures (Burns and Stalkers, 1961; Schein, 1985). In addition, according to Pierce and Delbecq (1977), less formalized organizations are more open and more ideas-rich, leading to organizational innovation.

Also skills and expertise of each members, needs and motivations, perception and attitude, and behavioral patterns are important resources that affect innovation given that they are related to perceive problems and develop solutions (Amabile, 1988; Damanpour, 1991; Teece, 1980). Positive attitudes and

active participation of individual also affect innovation (Leonard-Barton, 1988; Orlikowski, 1993).

Because the leader is in a position to define and manage the innovation, one’s capability to provide a proper vision, and to reconcile conflicting interests is considered one of the key factor of the innovation (Kanter, 1983). Variables such as years of service, educational background, and job-related experience also affect innovation (Kimberly and Evanisko, 1981).

Research Design



(Expected) Findings/Results

Classification		Innovation
Organization	Size	+ (larger)
	Support	+ (more supportive)
	Communication	+ (more active)
Individual	Characteristic	+ (There will be differences among job.)
	Education	+ (higher)
	Job Satisfaction	+ (higher)

Research limitations/ Implications

1. Implication

- empirical studies on organizational innovation in public sector
- using time series data, enhanced validity

2. Limitation

- data is based on individual perception, difficult to generalize

Keywords: Innovation, organization, public sector, job characteristic

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15.

The roles of business network centralities on firm performance: An explorative study in Tokyo manufacturing

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Abstract

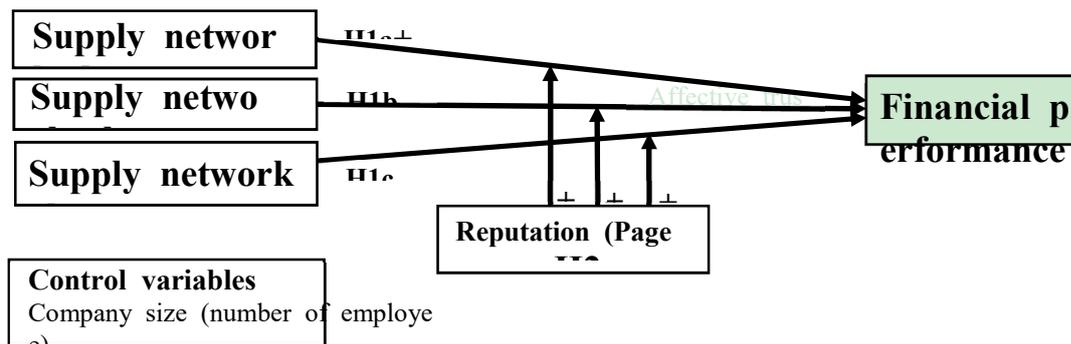
Purpose/ Research Question:

To examine the industrial relationships of three critical social network attributes, including out-(in-) degree, betweenness and closeness centralities (Geletkanycz et al., 2001; Freeman, 1978) on a firm's business performance (Tani et al., 2018; Kim and Lee, 2018; Yun et al., 2016).

To our best knowledge, the impacts of these three centralities on business performance in an industrial sector level have not been well examined together in literature, particularly in the context of Tokyo Electronics and Machinery industries.

To examine the roles of reputation (measured by PageRank/Eigenvalue) and stock-listing to the

relationships.



Key Literature Reviews (About 3~5 papers):

Recent supply chain management (SCM) literature: examine the roles of supply network positions, instead of traditional buyer-supplier dyadic relationships, on business performance (Wichmann and Kaufmann, 2016; Kim, 2014; Braziotis et al., 2013; Pilbeam et al., 2012). Some studies have assessed the roles of SC network positions on product innovation (Kim, 2017; Gao et al., 2015; Bellamy et al., 2014), environmental performance (Wichmann et al., 2015; Tachizawa and Wong, 2015), SC resilience (Kim et al., 2015; Carnovale and Yenyurt, 2015; Choi and Krause, 2006), operational performance (Dyer and Hatch, 2004; Choi, et al., 2001), and knowledge assess (Bellamy et al., 2014). Often social network (Kim et al., 2011; Borgatti and Li, 2009) and social capital perspectives (Bernardes, 2010) were adopted.

Social network analysis, as a way to investigate the structural characteristics of a network of knowledge, people, groups, organizations and geographical locations (Borgatti et al., 2013), is suitably adopted (Braziotis et al., 2013; Borgatti and Li, 2009; Wichmann and Kaufmann, 2016). Insufficient empirical supply network studies (Kim et al., 2011) and limited use of social network attributes (Wichmann and Kaufmann, 2016) are reported. However, it remains to be seen how different supply chain positions affects firm and supply network performance in an empirical way (Bellamy and Basole, 2013). SCM scholars may not be accustomed to all the social network measures to be used in the data analysis (Wichmann and Kaufmann, 2016; Ozkul and Barut, 2009). The contextual background including external market environment (Phelps, 2010) and internal organizational abilities relates to the supply network has also not been well examined (Gao et al., 2015).

Structural supply network centrality improves a firm’s sale performance. More supply chain ties, more alternative ways to achieve their business goals, to collect new or existing information, and to influence others in the supply networks (Burt, 2000; Hanneman and Riddle, 2005). Strengthened if the firm has higher reputation in the supply network. The high-reputation firms can strongly influence and take control of their supply network as other supply chain partners may aspire to partner with them (Chandler et al., 2013; Koka and Prescott, 2008).

From social capital perspectives,

- Social networks are valuable assets that comes from the resource accessibility through social relationships (Granovetter, 1992, 1973). An effective social network improves the access to social support, resources, information, and it constitutes cognitive, structural and relational elements (Lawson et al., 2008; Nahapiet and Ghoshal, 1998).

From social network perspective,

- Inter-organizational linkages such as bridging linkages (betweenness centrality) and network density (degree centrality) are important to get resources across firms (Burt, 1992). It gains autonomy, control & new information from the networks. Strong ties (closeness) improve mutual trust, which improves the useful knowledge transfer (Levin & Cross, 2004)

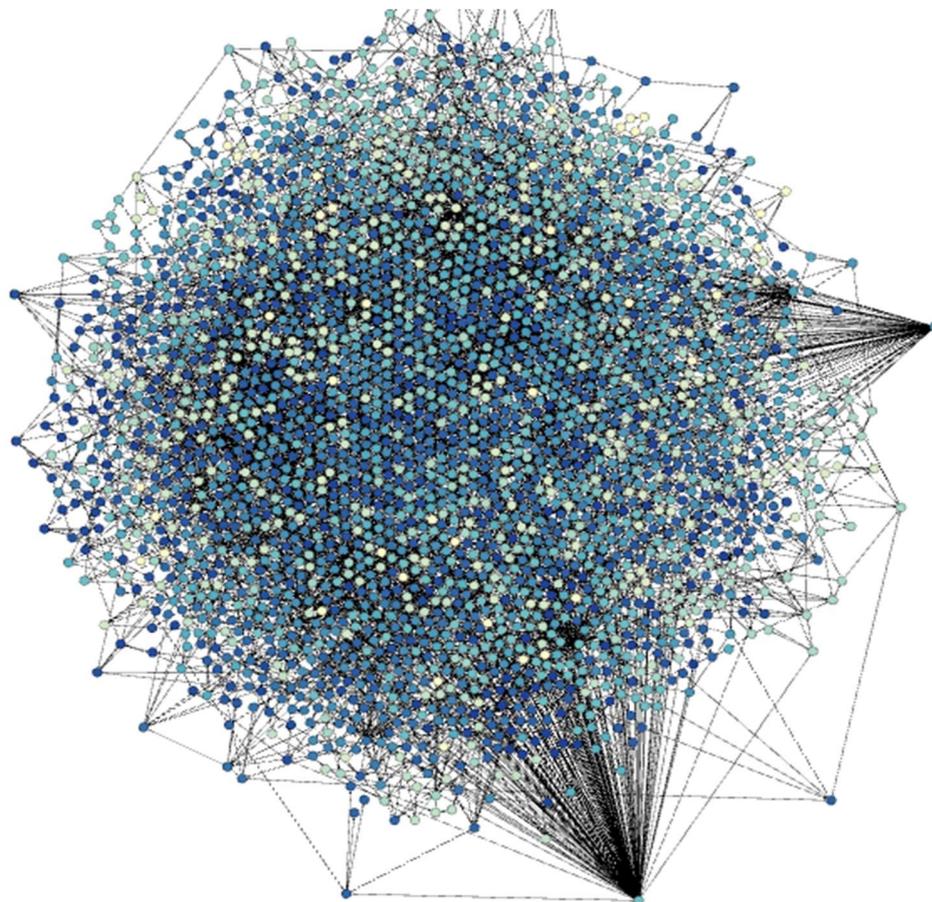
Thus, we believe that, in general, supply chain centrality improve firm's ability to gain resources and control of the supply chains, leading to better firm performance

Design/ Methodology/ Approach:

<p>The sampling of the companies</p>	<p>Tokyo registered companies with electronics, electrical appliance and machinery activities. 4183 private companies registered in Tokyo, according to the TDB database</p>
<p>Sampling</p>	<p>Firms with at least 5 customers and 5 suppliers were selected.</p>
<p>Sources</p>	<p>The data will be purchased from TDB and will be analysed by the collaborator in the University of Tokyo</p>
<p>Data collected:</p>	<p>Number of employee, Date of foundation, Revenue in 2016 and 2017, Profits, Address, Industrial categories, Financial service providers (e.g. Bankers), Top 5 supplier name, Top 5 customer name, & Company website (URL)</p>
<p>Networks studied</p>	<p>Supply chain ego-networks</p>
<p>Analysis methods</p>	<p>Network analysis, Moderated multiple regression analysis</p>

(Expected) Findings/Results: Here we showed a sample, similar study using Seoul data of 1188 firms presented in a Tokyo conference in 2018:

	Mean	S.D.
No of employees	57.15	217.92
ROE in 2016 (Won 1000)	54713804732.93	227516541130.27
ROE in 2015 (Won 1000)	90067340084.68	286398774972.74
Network measures		
Degree	0.00096661354	0.000118893622
Indegree	0.00048833091	0.000066051400
Outdegree	0.00047828258	0.000077990686
Closeness	0.01616742947	0.013271906577
Betweenness	0.00036206479	0.001658117311
PageRank	0.00022002494	0.000098283096
Eigenvalue	0.00286738614	0.018756795430



Companies are mainly dense, but a number of clusters (117 total with 601 over 5 firms).

Research Implications:

Extends the existing SCM literature by empirically exploring the impacts of degree, closeness and betweenness centralities on business performance in an industry-level supply network in Tokyo, Japan using social network analysis techniques.

Introduces the use of PageRank as a network measure to explore the roles of corporate reputation on business performance. This study extends the reputation literature by introducing a new measure for organizational reputation from the stakeholders of suppliers and customers (Boivie et al., 2016).

Explores how stock-listing and ownership types affect the impact of supply chain network on business performance.

Research limitations:

Limited to the sampled firm data collected. As we examine the supply network in a single country, we cannot study the effect of different institutional or cultural effects on the roles of supply network and performance. As the company data is cross-sectional, we cannot assume causality in our analysis

limited to the research variables tested as well as the data availability.

Acknowledgement: A related paper using Seoul data was presented on 2018 APAIB-UNBI Joint Conference on 30 June 2018. However, our paper will present new empirical findings by using new Tokyo data

Keywords: Supply chain network, Organizational reputation, network performance

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Open Collaborative Innovation in Informal Economy: The Emergence of Shenzhen Mobile Phone Industry

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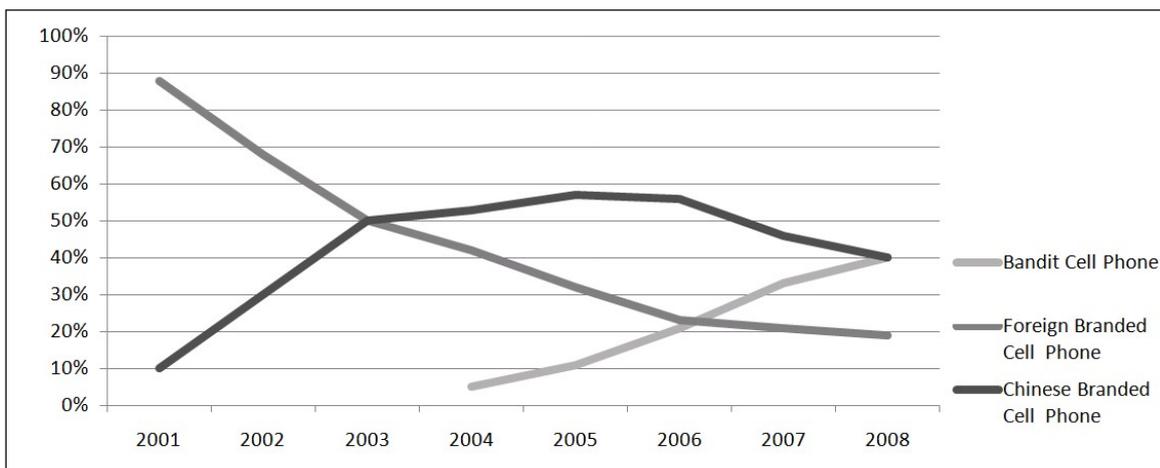
ABSTRACT

Purpose/Research Question:

This paper adopts the open innovation perspective to study the emergence of Chinese bandit cell phones since the early 2000s. Using an in-depth case study approach, we examine how entrepreneurial actors in the industry managed to overcome institutional constraints and achieve market dominance. We highlight three particular groups of actors that are important to open innovation in the creation of this industry. These groups include: (1) lead users, (2) foreign suppliers, and (3) ethnic groups.

Key Literature Reviews:

The origin of the Chinese bandit cell phone (also called Shanzhai Ji) industry dates to the early 2000s, when some volume of low-quality imitators were first sold in niche markets. Although illegal, the industry grew rapidly due to lax China license control regulation. By 2008, the market share of bandit cell phones reached 40 percent (refer to Fig. 1), and began to erode both foreign and Chinese branded cell phones market shares in China. During its evolution from obscurity to dominance, the industry has gained increasing recognition from the state, which in 2007 announced the lifting of license controls, fortifying the legitimization of the bandit cell phone industry. The purpose of this article is to examine how bandit cell phone entrepreneurial firms were able to break away from the status quo, innovate against dominant designers, challenge the state, and create a new industry in their interests.



Source: Digitimes (2009)

Figure 1. Cell Phones Market Share Trend in China

The paper adopts the format of a fine-grained case study (Yin, 1994). There are no formal hypotheses and there are certainly no formal tests. Rather, this paper follows the evolutionary path of Chinese bandit cell phones, and attempts to identify the strategies that the Chinese draw upon to compensate for their lack of resources, build legitimacy, and ultimately realize their interests and values. The heart of the paper is a narrative that follows the concept of open innovation to help structure our analysis. Open innovation refers to the processes which companies or entrepreneurs rely on—not just on their routines, but also the external ideas, resources, or paths required to advance their technology and find advantage (Chesbrough, 2003). Consistent with open innovation arguments, we analyze the ways in which the Chinese mobilized external networks, resources or

technologies to overcome institutional constraints and achieve dominance.

The basic findings of this paper are simple. For the Chinese, with low legitimacy and limited resource, a managerial practice strategy of innovating against the state or standard may not be easy, yet is viable. Bandit cell phone manufacturers act like entrepreneurs, helping identify markets, channels, and customer needs, and mobilizing resources. As expected, the resources that empower their strategy are from both the internal organization and the external environment. The sources for strategy are manifold, but critical sources are: (1) lead users, such as farmers who provide a source of disruptive innovation; (2) foreign suppliers, notably the Chinese chip makers such as MediaTek, whose introduction of a total solution helped lower entry barriers and shorten the design cycle; and (3) ethnic groups, centered on the community of ChaoShan¹ that provided an important source of trust, information sharing, and resource exchange required to adjust smoothly to changing market conditions and identify opportunities (Dittrich and Geert, 2007; Karim and Boudreau, 2009). Appreciation of three sources—lead users, foreign suppliers and ethnic groups, are important to open innovation that contributes to create the innovative Chinese bandit cell phone industry (Laursen and Salter, 2006; Almirall and Casadesus-Masanell, 2010; Egbetokun et al., 2017; Grosse, et al., 2018).

Design/ Methodology/ Approach:

The time frame of our analysis spans from 1999 to 2009. We trace data back to 1999 because the Ministry of Information Industry (MII) of China issued a new regulation titled the “Arrangements for the Approval of Network Access of Telecommunications Equipment” in 1999.

Both secondary and primary sources provide the data for this study. Our secondary sources are based on five distinct sets of data: (1) the China National Knowledge Infrastructure (CNKI) website (www.cnki.com.cn) which is the key national project of China established since 1996; (2) the China Center for Information Industry Development (CDID) reports; (3) official data released by Ministry of Industry and Information Technology, National Bureau of Statistics (NBS) of China, Shenzhen Government, Shenzhen Customs District, and Statistics Bureau of Shenzhen Municipality; (4) Shanzhaiji (www.shanzhaiji.cn/), a popular bandit cell phone forum; and (5) a local bandit cell phone advertising weekly paper. A flexible use of secondary data, combined with opportunistic searching for informants, is necessary due to the lack of reliable data in China, and especially for illegitimate and illegal bandit cell phones.

We conducted personal interviews in China and Taiwan to provide an important source of technologies in cell phone chips. We also identified the importance of collecting data through Internet, especially the instant messenger QQ, which is the most popular website in China. Usually, we can see people relying on QQ to operate their bandit cell phones business. We triangulated our data to help guide our analysis.

Findings: Cell Phones Industry in China

The first cell phone call was made from the New York street in the 1973, and throughout the 1980s, many different cell networks and cell phones were introduced by Western and Japanese companies. The global cell phone industry has been dominated by Western Europe, Japan, and the United State for more than thirty years (Steinbock, 2001), and these nations have built up high entry barriers in technology and capital requirements. China, which initiated telecommunications in 1987, is the largest producer of branded cell phones, and provides outsourcing services for Nokia, Motorola, and other major companies. It is estimated that the cell phone output of China reached 560 million units in 2008, accounting for 47.46 percent of the world total output of 1.18 billion units (MIIT, 2009). With the rapid growth of Chinese cell phone manufacturing ability, China is no longer just a follower, but has established a Chinese-style bandit cell phone industry. Although the number of bandit cell phones cannot be counted precisely, it is reputed that bandit cell phones shipments reached 145 million units in 2008, amounting for 12.9 percent of the world total output of 1.13 billion legitimate cell phones (iSupply.

¹ The name "Chaoshan is a contraction name of two areas, Chaozhou and Shantou, geographic proximity to ShenZhen.

2009).

BANDIT CELL PHONES INDUSTRY IN CHINA: AN OVERVIEW

Illegal Industry Gangs Up at Shenzhen

China began to make major economic reforms in 1978, and in 1980, established special economic zones (SEZs) in Shenzhen. The Government gave these SEZs special economic policies and flexible governmental measures, and also provided infrastructure support and offered special tax to attract more foreign technology and investments. Due to large foreign investment and technology, the industry in Shenzhen grew rapidly and formed a complete electronic supply chain (Tao and Lu, 2009). Before bandit cell phones, bandit DVD and MP3 industries existed in Shenzhen. Although bandit DVDs and MP3s were not very successful, a large number of companies with electronic manufacturing ability entered the cell phone industry. During the early 2000s, a series of NOKIA-like cell phones emerged in Guangdong, and priced at one fourth of the real NOKIA's cost. These imitators went against the regulation entitled "arrangements for the approval of network access of telecommunications equipment," generally call "document No. 5," issued by the National Plan Commission and MII in December 1998. This regulation claimed that all telecom equipment used in China must have a Network Access License (NAL) and a Network Access Identifier (NAI) from MII. A cell phone without these licenses is illegal, and called a "black cell phone," which is a previous name of bandit cell phones. These cell phones were produced by opportunistic manufacturers who evaded Government management, and were illegal. Since these opportunistic manufacturers were not under supervision of the Government, they did not need to pay tax and were not afraid of infringing intellectual property rights.

A legal cell phone in the early 2000s should have the following codes: network access code issued by MII, phone model number, scrambling code, International Mobile Equipment Identity (IMEI)² code, and Serial Number (SN) code (Wu et al., 2009). However, bandit cell phones used fake codes because getting real codes might take six months or more. This process also cost at least 40,000 RMB. Moreover, bandit cell phones initially adopted Korean chips, and the quality was poor. Also, customers could not find any manufacturer's information outside the box, and of course, no after-sale service. As a result, in the early stages, bandit cell phones came to signify "copy," "imitation," "fake," or "poor quality."

The Catalyst- MediaTek

Nevertheless, after MediaTek chip were widely adopted in 2005, the failure rate of bandit cell phones decreased to 4~5 percent". MediaTek is a Taiwanese company, which spun off of United Microelectronics Corp (UMC) in 1997. It developed a turnkey solution chip that provided highly integrated hardware and a total software total (Pan, 2006). This chip enabled bandit cell phone companies without R&D ability to put their attentions on industry design, mechanical design, and supply chain management, and also enhance their cell phone stability to compete with branded cell phones (Pan, 2006). Although MediaTek's chip is powerful, MTK6226B, the most popular chips with Bluetooth, hand writing functionality, multimedia capability, and a built-in camera, it is priced at only 9 RMB in the market. More than 90 percent of bandit cell phones use MediaTek's chip (Chiang, 2008). MediaTek's chip has lowered the cell phone industry entry barrier and encourages more people enter the market. In 2005, the total amount of bandit cell phone manufacturers increased rapidly from 300 to over 1000, and Shenzhen has become the center of the bandit cell phone industry.

Also in 2005, because the Government wanted to attract more manufacturers to become legal ones, the Government relaxed regulation of manufacturing cell phone in February. However, the process was still time-intensive and fees were still too high, so illegal imitators were not interested in certification. However, the problems of obtaining legal licenses did not bother the bandit cell phone industry too much because opportunistic manufacturers had already identified low-level customer demand in the market. These customers

² IMEI (International Mobile Equipment Identity) is a unique 15-digit code used to identify an individual GSM cell phone in a GSM network.

were not been aware of what intellectual property (IP) was or what a brand meant (Choi, et al., 2018; Ma et al., 2018).

Potential Lead Users

China's economy has taken off in recent years, leading to a jump in demand for modern product in small towns. According to the second agricultural census conducted by NBS in China, every 100 families had 51.9 fixed telephones, but 69.8 cell phones (National Bureau of Statistics of China, 2006). People living in the countryside purchase cell phones as their first phone, and most of these cell phones are bandit phones. The average monthly salary in China in 2000 was about 600 RMB (National Bureau of Statistics of China, 2006), meaning that most people cannot afford to buy Nokia or Motorola. Although the 1.3 billion-person market in China has attracted many foreign cell phone companies, most of these companies have long ignored low-income customers, while bandit cell phone manufacturers do their best to cater to the tastes of these consumers. The amount of low-income customers, whose monthly salaries are lower than 1000 RMB, was more than 630 million in 2000 (The Team of China First Economic Census, 2006), giving bandit cell phones manufacturers a chance to survive.

Rescind the Regulation

In October 2007, another development favored bandit cell phone manufacturers. The state council of China promulgated a motion to rescind the requirement for a license to manufacture cell phones, and new regulations were planned for 2008. After 2008, cell phones without a license did not break the law, but many of them still infringed IP rights. Without manufacturing license requirement, bandit cell phones manufacturers did not need to buy and copy NAI from people who had applied for the license. On the black market, a NAI was priced at 30~50RMB. Therefore, the abolishment of this license requirement benefited bandit cell phone manufacturers with lower costs, allowing them to further improve their competitive advantage in the market. The New York Times reported that a \$100~\$150 bandit cell phone costs approximately \$40, for a cost that is 26~40 percent of the price (Barboza, 2009). The high margin in the bandit cell phone industry has attracted more people to join in.

The Community of ChaoShan

It is hard to precisely count the number of bandit cell phones, but conservative estimates put the number of companies in Shenzhen related to bandit cell phones at about 1000~3000 (Zou, 2008). A great number of these bandit cell phone manufacturers are derived from the electronics manufacturers ganging up in Shenzhen during the early 2000s, and lots of these electronic manufacturers came from ChaoShan. In Chinese society, *guanxi* networks play an important role in business (Park and Luo, 2001), and a lot of business associations are based on townsmen associations. People from ChaoShan associate together and share information only with their people from ChaoShan, and they show strong community identity and sense of belonging in bandit cell phone industry (Ramos-Mejia and Balanzo, 2018). MacKenzie (2008) showed that trust plays an important role in the mediation of the subcontract relationships in Irish Telecommunication. ChaoShan also demonstrates highly business trust, which can result in tightly interfirm networks that enable them to act dynamically, making the market more flexible, innovative, and faster (Dittrich and Geert, 2007; Dougherty, 2017; Kitamura et al., 2018). As a result, the community identity of ChaoShan has empowered the development of bandit cell phone industry in China.

Research Implication:

The significant output value of bandit cell phone industry could have an impact on Shenzhen's economic development, and could be the next big thing of the world. As a result, we hope to identify the secrets behind the bandit cell phone industry in China and realize how this illegal underground industry overcame institutional constraints and achieved dominance.

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Analysis of Factors Influencing the Matching of Ride-Hailing Service using Machine Learning Method

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Abstract

Purpose/ Research Question

Purpose: This study used T-map taxi service data that occurred in April 2017 for Seoul and Daejeon Metropolitan City in Korea. Logistic regression and decision tree algorithms based on machine learning were used, and the importance of variables affecting app taxi matching was analyzed.

Research Question: Recently, the online to offline industry has been growing greatly. Especially in the transportation sector, the service of app taxis is growing greatly. However, the introduction of such a ride-hailing service caused problems such as picking up passengers or refusing to ride the taxi driver and caused problems in improving the service. Therefore, it is necessary to draw a direction for service improvement based on factor analysis of that affect matching of app taxi service.

Key Literature Reviews

1. Matthew et al. (2018) used multivariate analysis to see the increase of sharing transportation, such as Uber or Lyft, from 0.5% in general to 10% in a certain month through the 2017 National Household Travel Survey (NHTS). They found that sharing transportation was associated with transit and nonmotorized transport and was negatively correlated with car ownership and that residents in densely populated areas were more likely to use sharing transportation.
2. Li et al. (2018) combined a single departing point (OD) fare network with cars and public transportation to analyze a multiple modal path selection model. They found that the presence of mileage may not only cause a driver to choose a lane but also to decide on driving behavior which can minimize an actual toll and that the analysis model had comparable problems with complementation. In addition, they analyzed the effects of primary factors on the basis of numerical examples of sharing transportation. Passengers' reward and tolls for an exclusive driver on main streets might strongly affect a driver's selection of a path and driving behavior; the greater reward (tolls) passengers gave, the larger number of drivers showed eco-friendly driving behavior.
3. Saadi et al. (2017) used data from a major Chinese ride-hailing service provider, DiDi Chuxing, to analyze temporal and spatial estimation of the demand through several types of machine learning in an attempt to characterize and predict the short-term demand for ride-hailing service like Uber. The machine learning involved decision tree, bagged decision tree, random forest, the gradient boosted decision tree, and artificial neural network for regression. The gradient boosted decision tree had the lowest RMSE (16.41), followed by the artificial neural network (20.09), the random forest (23.50), the bagged decision tree (24.29), and the decision tree (33.55); thus, demand prediction using the gradient boosted decision tree could meet the driver's

requirements more efficiently.

4. Yoo et al. (2018) performed decision tree method and discriminant analysis in groups that preferred and not supporting support policy for small and medium enterprises in Korea to find ways to effectively implement research and development (R&D) support policy for small and medium enterprises.
5. Lee and Kim (2018) analyzed the residential relocation distance using regression and decision tree method to assess the applicability of the machine learning method of households to the Seoul metropolitan region of Korea.

Design/ Methodology/ Approach

Design

The OD data concerning successful and unsuccessful call matching by drivers in T-map taxi service of Seoul and Daejeon in April 2017 were used.

<Table 1> Overview of data

Matching type	Seoul		Daejeon	
	N	Rate(%)	N	Rate(%)
Success	11,010	35.5	2,228	51.9
Fail (by Driver)	10,775	34.8	884	20.6
Fail (Passenger)	9,069	29.3	1,155	26.9
The other	136	0.4	27	0.6
Total	30,990	100.0	4,294	100.0

To perform logistic regression analysis and apply the decision tree, success and failure in taxi matching, which scored 1 and 0, respectively, were designated as dependent variables, and the factors for matching, as shown in the following table, were designated as independent variables.

<Table 2> Variables applied in the analysis

Variable		Unit	
Social and economic indicator	Origin	Population density	10,000 person/km ²
		Business density	10,000 person/km ²
		Worker density	10,000 person/km ²
	Destination	Population density	10,000 person/km ²
		Business density	10,000 person/km ²
		Worker density	10,000 person/km ²
Distance		Km	

Weather(by day)		Sunny(0), Cloudy(1)	-
Time zone		Non-peak time(0,0), peak time(0,1), Midnight(1,0)	-
Day of the week ¹⁾		Weekday(0), Weekend(1)	-
Origin	Land use ²⁾	The other(0,0), Commerce(0,1), Residence(1,0)	-
	Whether to station influence area	Non-station influence area(0), Station influence area(1)	-
Destination	Land use ²⁾	The other(0,0), Commerce(0,1), Residence(1,0)	-
	Whether to station influence area	Non-station influence area(0), Station influence area(1)	-

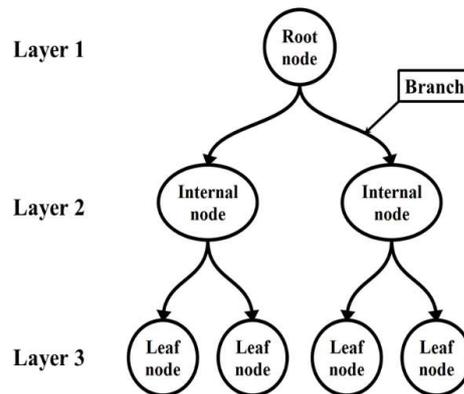
1) Weekday: Monday ~ Thursday, Weekend: Friday ~ Sunday

2) The other: Natural green area, Semi-industry area, Productive green area, Commerce: General-Central-Neighboring-Distribution commercial area, Residence: Semi-residence-Exclusive-General residential area

Methodology

1. Decision tree

As one of the machine learning algorithms, it is to chart several decision-making rules and classify or predict a few small groups concerned.



<Fig. 1> Decision tree structure

Decision trees are divided into Chi-squared automatic interaction detection (CHAID), classification and regression trees (CART), C 5.0, C 4.5, and iterative dichotomiser 3 (ID 3) according to the splitting criteria and stopping rules that prevent data splitting from occurring any more, and the basic type of model is shown in Figure 1.

An analyzer can easily understand a model because the decision trees have a structure of trees. In addition, because it is a non-parametric method not requiring assumption of linearity, normality, or homoscedasticity, with only ranking affecting analysis, it is not sensitive to outliers and is superior to the existing statistical models in terms of prediction.

Therefore, this study used a CART algorithm forming a regression tree as the dependent variables were continuous. The CART algorithm performs binary split, has different splitting criteria, and

forms a classification tree with discrete dependent variables and a regression tree with continuous dependent variables. Of these, a classification tree uses the Gini coefficient shown in the following equation as a splitting criterion to form a tree. As a measure of impurity or diversity in each node, the Gini coefficient means the probability that two elements randomly extracted among the total elements belong to different groups.

$$G = \sum_{j=1}^c P(j)(1 - P(j)) = 1 - \sum_{j=1}^c P(j)^2 = 1 - \sum_{j=1}^c (n_j/n)^2$$

G : Gini coefficient

c : Number of categories of target variables

$P(j)$: The probability that an object in each node belongs to the j th category of the target variable

n : The number of observations included in node

n_j : Number of observations in the j th category of the target variable

A classification tree chooses the dependent variable that reduces the Gini coefficient to the greatest degree and the optimal splitting of the variable as childnodes, and the decrease in the Gini coefficient is estimated as follows: This is to form childnodes so that impurity is at the lowest level in case of classification into childnodes.

$$\Delta G = G - \frac{n_L}{n} G_L - \frac{n_R}{n} G_R$$

ΔG : Decrease in Gini coefficient

G : Gini coefficient of parent node

n : Number of observations in the parent node

n_L, n_R : Number of observations in the left and right child node

G_L, G_R : Gini coefficient for the left child node and the right child node

This study used Scikit-Learn among libraries for Python programming languages. Python, an open source, contains libraries necessary to visualize data, make statistical analysis, and process languages because it is equipped with convenience in specialized script languages in certain areas, such as Matlab or R, in addition to the strengths of general-purpose programming languages. Of several libraries of Python, Scikit-learn can favorably provide a user-friendly, efficient, and productive interface in using an algorithm. Scikit-learn is utilized through such distribution versions of Python as Anaconda, Enthought Canopy, and Python (x, y); in particular, Anaconda is useful in analyzing mass data and in making predictive analysis. Therefore, this study used Anaconda among several distribution versions of Python to perform decision tree analysis that might form a regression tree.

2. Logistic regression analysis

Logistic regression analysis is a statistical model that expresses the association between

independent and dependent variables in a function like general regression models. While it is similar to general regression models in that it uses linear combination of independent variables to explain dependent variables, it is given as the probability that categorical data used as input belong to a certain class. While dependent variables range from $-\infty$ to $+\infty$ in general regression models, the values range from 0 to 1 in an S-shaped logistic function in logistic regression models. The regression coefficient in logistic regression models is used to explain the association between dependent and independent variables like general linear regression coefficients. However, while a linear regression model uses the least squares method to estimate the regression coefficient, a logistic regression model uses the maximum likelihood estimation method. The analysis applied a machine learning algorithm better at predicting explanatory power and at building an efficient model than the conventional methods. The algorithm was used through Anaconda to analyze the factors for app taxi matching.

(Expected) Findings/Results:

Finding

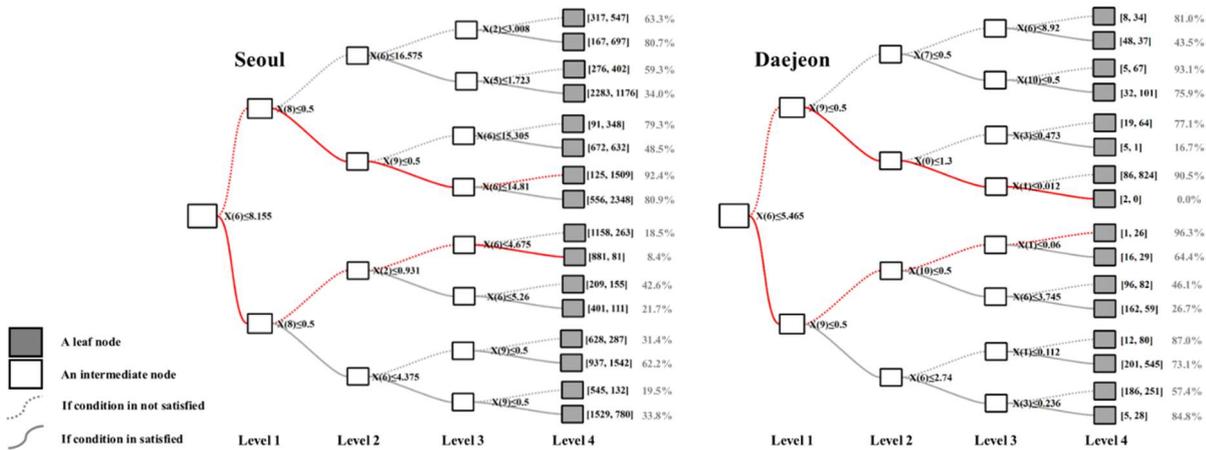
The logistic regression analysis found that the explanatory power for training and testing sets was estimated at 0.719 and 0.719, respectively in Seoul and at 0.757 and 0.778, respectively in Daejeon. In Seoul, ten variables, including population density and employee density of the departing point, population density and business density of the destination, travel distance, dull weather, midnight, peak time, and railway station spheres of the departing point and destination, were statistically significant. Of these, high population density of the departing point, high business density of the destination, and longer travel distance positively affected the rate of successful matching. In Daejeon, eight variables, including population density and employee density of the departing point, employee density of the destination, travel distance, dull weather, peak time, and residential and commercial areas of the departing point, were statistically significant. High employee density of the departing point, longer travel distance, and a residential or commercial area of the departing point positively affected the rate of successful matching.

In the decision tree, the explanatory power for training and testing sets was estimated at 0.72 and 0.723, respectively in Seoul and at 0.757 and 0.766, respectively in Daejeon. As non-parametric analysis, a decision tree determines the importance of dependent variables, not the regression coefficient. The 'travel distance' had the strongest impact on app taxi matching in both cities.

As an algorithm showing an analysis model in the shape of trees, a decision tree can analyze mixed effects of the factors for taxi matching, as shown in the following figure. In the figure, gray rectangles mean leaf nodes composed of 16 nodes in both cities, with internal nodes being expressed using 15 white rectangles in each city. The white rectangle on the far left means a root node at which the tree structure starts to track learned data classification.

In the structure of the model, solid lines mean movement into lower items if the requirements of internal nodes are met; wavy lines mean movement into upper items when the requirements fail to be met. The equation at the right side of nodes means the conditions for splitting the sample assigned

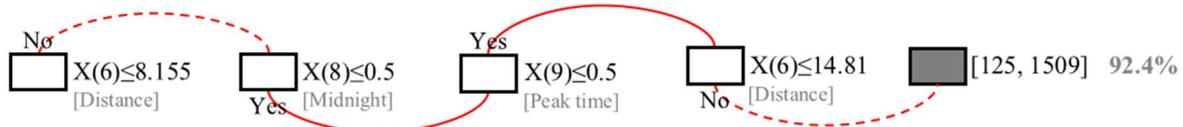
to each node, with X(n) meaning the independent variables in Table 3. The number in parentheses at the right side of leaf nodes means the number of samples in case of successful and unsuccessful taxi matching, with the % number being the probability of taxi matching. It is possible to analyze the whole structure in a decision tree model; this section tries to determine the highest and lowest rate of taxi matching in Seoul and Daejeon, as expressed as the red line in the figure.



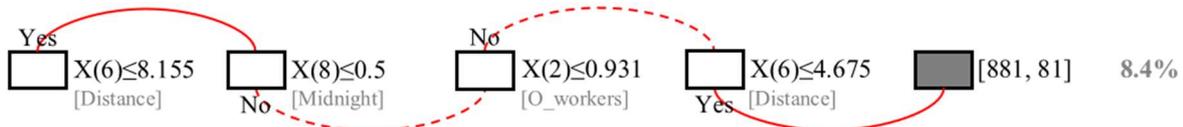
<Fig. 2> Decision tree for factors affecting matching of ride-hailing

The highest rate of taxi matching in Seoul is 92.4%. The factors for path selection in the leaf node include X(6) travel distance, X(8) midnight, and X(9) peak time status. This path involves longer travel distance during non-peak time in the daytime. The lowest rate of matching was 8.4%; the factors for selection of this path include X(6) travel distance, X(8) midnight, and X(2) employee density of the departing point. The path involves relatively short travel distance at midnight.

[The branch path to the leaf node with the highest matching rate]



[The branch path to the leaf node with the lowest matching rate]



<Fig. 3> Detail branch paths to the leaf nodes with the highest and the lowest matching rate (Seoul)

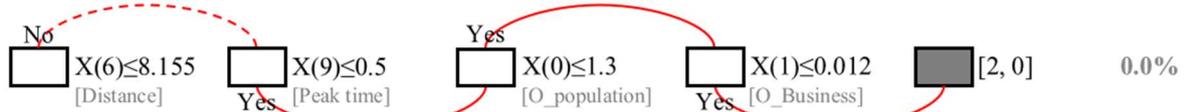
The highest rate of taxi matching in Daejeon is 96.3% in case of peak time on weekends, higher business density, and longer travel distance. In this case, X(6) travel distance, X(9) peak time, X(10) weekend status, and X(1) business density of the departing point affect path selection. The lowest rate of taxi matching is 0% in case of midnight, peak time in the daytime, lower business and population density of the departing point, and shorter travel distance. In this case, X(6) travel distance, X(9) peak

time, X(0) population density of the departing point, and X(1) business density of the departing point affect path selection.

[The branch path to the leaf node with the highest matching rate]



[The branch path to the leaf node with the lowest matching rate]



<Fig. 4> Detail branch paths to the leaf nodes with the highest and the lowest matching rate (Daejeon)

Results

1. The decision tree analysis found that travel distance had the strongest effect on the rate of successful call matching in both cities
2. In Seoul, the longer travel distance, the higher probability of call matching; in particular, midnight, higher employee density of the departing point, and longer travel distance lead to higher probability of call matching.
3. In Daejeon, the longer travel distance, the higher probability of call matching; in particular, peak time in the daytime on weekends, higher business density of the departing point, and longer travel distance lead to higher probability of call matching.

Research limitations/ Implications:

Limitations

1. The survey in 1,500 South Korean smartphone users in their twenties to forties found that the most frequently used type of app taxi service in South Korea was Cacao Taxi (98%), with T-map taxi accounting for 10%. So the results of the analysis using the data concerning T-map taxi service in this study can hardly be generalized.

Implications

1. The addition of machine learning and variables not included in the analysis model gave more accurate prediction of car operation and better explanation in factor analysis.
2. Using data concerning Cacao Taxi, which is most frequently used in South Korea, is expected to enable the findings to be generalized.

Keywords: Machine Learning, Decision Tree, Logistic regression, Ride-Hailing Service

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18.

A Data Mining Method of OLED Patent Technology in Chemical Field Based on Content Analysis

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Abstract

This paper presents a data mining method of OLED technology in chemical field based on the frequency data of patent content, analyzes in detail its temporal and spatial trends for the period 2000-2016, uses the comprehensive index with the average value method to evaluate its core patents and the patent cosine similarity with the TF-IDF algorithm to get its similar patents. The thesis' conclusions are as the following:1) It shows a downward trend of OLED patent technology inputs in recent years, as meanwhile its average maturity has been fairly high with the synchronized development of its material technologies and its components technologies; 2) Most of its family patents focus mainly in the United States, South Korea, Europe, Japan, WO and Taiwan patents;3) The top 20 core CN patents mainly come from the United States, South Korea, Germany and China patents, in which there is a great similarity difference in South Korea's similar patents mostly from their own enterprise patents. Among the top patents, the Samsung Corp. has the largest similar patents.

Keywords

Data mining, OLED patent, Content analysis

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Integration of Kano's Model into QFD for Product Design

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Abstract

With increasing concerns on customer needs in today's competitive market, the issue of incorporating customer requirements into product design brings the interest of both researchers and practitioners. Quality Function Deployment (QFD) is a well-known methodology for customer-driven product design. A problem is that QFD analysis has a major challenge in understanding customer needs accurately. Kano's model, on the other hand, studies the nature of customer needs and provides a way for a better classification of customer needs. However, seldom research contributions are found in terms of integrating Kano's model with QFD quantitatively. In this research, a new framework is proposed for integrating Kano's model into QFD. At first, Kano's model is quantified by identifying relationship between customer needs and customer satisfaction (CS). Next, both qualitative and quantitative results from Kano's model are integrated into QFD. Finally, a managerial analysis is performed to derive the strategies for the management of customer satisfaction. In this research, an illustrative example associated with the design of car interior is presented to demonstrate the availability of the proposed approach.

Keywords: Quality Function Deployment (QFD), Kano's model, S-CR functions, managerial analysis, Customer needs

Purpose/ Research Question

Customer needs are a critical factor that companies across all industrial sectors face in customer-driven product design (Ji *et al.* 2014). How to identify, understand and respond to customer requirements (CRs) efficiently and effectively becomes an essential prerequisite to offer a customer-satisfied product. Many companies make their efforts to offer customer-driven products to differentiate themselves from competitors. In addition, a number of methods and tools are adopted to identify CRs, incorporate the requirements into product design to meet customer needs and achieve higher customer satisfaction (CS).

In customer-driven product design, one of the most well-known approaches is Quality Function Deployment (QFD), which translates customer requirements into engineering characteristics (ECs) for design, development and delivery of a product (Kim *et al.* 2015, Cho *et al.* 2016, Leber *et al.* 2018). However, one of the critical challenges in QFD is that how to understand CRs and how to associate CRs with CS are not explained clearly. Traditional customer survey methods are usually adopted in QFD to collect CRs and determine their degree of importance. The detailed methods on how to collect customer data are not clearly defined.

Kano's model, which studies the nature of CRs, offers a solution to this problem. It is often used to categorize CRs into different types, which helps designers to capture CRs, understand CRs and their impact on CS (Wu *et al.* 2018). Compared with QFD, however, the relationship between CRs and CS in Kano's model is not specified quantitatively. Its motive to integrate the Kano's model into QFD for product design will help the product designers to analyze CRs directly. But current research on the integration of these two methodologies is limited.

Kano's model acknowledges different types of relationships between CRs and CS (Xu *et al.* 2009). However, it only focuses on the classification and qualitative analysis about different Kano categories of CRs. Little research is conducted on the analysis of Kano's model in a quantitative way. In addition, Kano's model is simply one solution to address the difficulties of QFD analysis in understanding and capturing CRs. How to integrate the results of Kano's model into QFD is another major concern. Many integration approaches focus more on qualitative analysis and integration of these two methodologies. It is imperative to develop a uniform and robust approach to quantitatively integrate Kano's model into QFD.

Key Literature Reviews

The integration of Kano's model into QFD has been studied over the years. Generally, Kano's model is associated with QFD in literature as the starting point of the QFD process to collect and analyze CRs. Based on Kano's model, a method was proposed to categorize CRs into different groups and to assess their strategic importance by calculating CS and DS values (Matzler and Hinterhuber 1998). This categorization of CRs is then used as a basis for QFD analysis. Variants of Kano's model were also proposed by the introduction of three Customer Satisfaction Coefficients (Tontini 2007). The modified Kano's model was integrated into the planning matrix of QFD, with an example to demonstrate the application of the proposed integration approach. Sireli, Kauffmann, and Ozan (2007) further advanced Matzler and Hinterhuber's approach by including a widely accepted scoring

method and a statistical significance test for the integration of Kano's model and QFD. However, these approaches remain to be qualitative descriptions of QFD and Kano's model with little quantitative analysis involved.

Shen *et al.* (2000) proposed an integration approach in which Kano's model is used to develop an approximate transformation function for determining the degree of importance for each CR in the planning matrix of QFD (Tan and Shen 2000). However, this approach tends to be subjective and vague, because the selection of parameters for different Kano categories in the transformation function basically depends on QFD practitioners' experience and knowledge.

Design/ Methodology/ Approach

5. Classification of customer attributes

In this proposed approach with regard to Kano's model, two tasks should be tackled:

5.1. Classifying customer attributes into Kano categories

5.2. Choosing the proper transformation function for customer attributes in each category.

Kano's model has three main customer attributes, must-be, one-dimensional, and attractive, as well as two additional customer attributes, indifferent and reverse. Through a Kano questionnaire that consists of a pair of questions (one positive and one negative) and a Kano evaluation table, all customer requirements can be classified into five Kano categories.

6. Adjustment of improvement ratio

In this research, a transformation function (Chaudha 2011) is used to adjust the improvement ratio of each customer requirement:

$$IR_{adj} = (1+m)^k \times IR_0 \quad (1)$$

where IR_{adj} is an adjusted improvement ratio and IR_0 is a traditional improvement ratio (taken from a survey), $m = \max(|DI|, |SI|)$ is an adjustment factor, and the value of k is a Kano coefficient determined by the Kano category. In this paper, the value of k is taken as 0, 0.5, 1, and 1.5 for indifferent, must-be, performance, and attractive attributes, respectively.

7. Quantitative analysis of Kano's model

Before a quantitative analysis of Kano's model is performed, the traditional Kano's model is used to identify the Kano category for each customer requirement. A quantitative analysis is then conducted based on the preliminary qualitative results from Kano's model.

The quantitative analysis of Kano's model begins with calculating CS and DS (Ji *et al.* 2014).

$$CS_i = \frac{f_A + f_O}{f_A + f_O + f_M + f_I} \quad (2)$$

$$DS_i = \frac{f_O + f_M}{f_A + f_O + f_M + f_I} \quad (3)$$

where f_A is the total number of attractive attributes, f_O is that of one-dimensional attributes, f_M is that of must-be attributes, and f_I is that of indifferent attributes taken from the survey results. Two assumptions are made at this point:

7.1. If one product offers a certain CR (existence) or it is fully fulfilled, the fulfillment level of the CR is one.

7.2. Otherwise, the fulfillment level of the CR is zero.

According to the two assumptions, CS and DS points can be defined. The CS point of a CR, which can be expressed as $(1, CS_i)$, is the level of CS when the CR is fully fulfilled. The DS point of a CR, which is expressed as $(0, -DS_i)$ is the extent of customer DS, when the CR is fully unsatisfied..

8. S-CR relationship functions

Given the CS and DS points, the plot of the relationship between CS and the fulfillment level of customer requirement (S-CR) is determined. The S-CR relationships are quantified approximately by an estimation function. It is denoted by $S_i = f(y_i, a, b)$ where S_i is the level of CS achieved by CR_i , y_i represents the level of fulfillment of CR_i , and a and b are tuning parameters for different Kano's categories of CRs.

For the one-dimensional CRs, S-CR relationship is estimated by linear function, $S_i = a_i x + b_i$

$$a_i = CS_i - DS_i, \quad b_i = DS_i \quad (3)$$

For attractive attributes, the curve can be approximated by an exponential function $S_i = a_i e^x + b_i$

$$a_i = \frac{CS_i - DS_i}{e - 1}, \quad b_i = \frac{CS_i - eDS_i}{e - 1} \quad (4)$$

Similarly, the S-CR curve of must-be attributes can also be estimated by an exponential function, $S_i = a_i(-e^{-x}) + b_i$

$$a_i = \frac{e(CS_i - DS_i)}{e - 1}, \quad b_i = \frac{e(CS_i - DS_i)}{e - 1} \quad (5)$$

Table 1. S-CR relationship functions

KC	a	b	f(x)	$S_i = af(x) + b$	
A	$\frac{CS_i - DS_i}{e - 1}$	$\frac{CS_i - eDS_i}{e - 1}$	e^x	$S_i = \frac{CS_i - DS_i}{e - 1} e^x + b_i = \frac{CS_i - eDS_i}{e - 1}$	(6)
O	$CS_i - DS_i$	DS_i	x	$S_i = (CS_i - DS_i)x + DS_i$	(7)
M	$\frac{e(CS_i - DS_i)}{e - 1}$	$\frac{e(CS_i - DS_i)}{e - 1}$	$-e^{-x}$	$S_i = \frac{e(CS_i - DS_i)}{e - 1} (-e^{-x}) + \frac{e(CS_i - DS_i)}{e - 1}$	(8)

9. Quality Function Deployment (QFD)

See Cho *et al.* (2016) for the detailed explanation of Quality Function Deployment (QFD).

Partial Findings/Results

This research deals with a case study of car interior design. This case starts with collecting Voice of Customers (VOC). In order to identify the VOC, customer needs, MBA students who have driven cars for last several years were interviewed. The survey form consists of self-importance rating,

customer satisfaction rating, and Kano questionnaire for each customer attribute. Table 2 shows the customer requirements collected from the survey.

According to the survey responses, the Kano classification (KC), CS and DS values for each CR are obtained. Part of the results is demonstrated in Table 3. Once CS and DS points are calculated, the next task is to determine the plot of the relationship between CS and the fulfilment level of customer requirement (S–CR). The horizontal axis is the CR value which ranges from zero to one and the vertical axis is the level of CS which ranges from minus one to one. For example, if a customer requirement is an attractive attribute with its CS and DS points, it follows an exponential curve, which passes the CS and DS points. Similarly, the relationship curves for one-dimensional and must-be attributes can also be described. Part of the curves is plotted in Figure 1.

Table 2. Customer Requirements

1. Flexible design
2. Comfortable and Good ergonomics
3. User friendly and convenient
4. No vibration and noise
5. Good safety design
6. Attractive design
7. Reliable design
8. Good material quality
9. Cost effective
10. Good air circulation system

Table 3. Part of Kano survey results

Customer Requirements	CS	DS
No vibration and noise	0.57	-0.57
Good safety design	0.67	-0.57
Attractive design	0.42	-0.20
Reliable design	0.52	-0.40
Good material quality	0.40	-0.27
Cost effective	0.34	-0.24
Good air circulation system	0.48	-0.50

According to the results, several customer requirements are classified as indifferent attribute. They are not included in the further analysis due to their low impact on CS. Then, the proposed quantitative analysis is applied. Appropriate equations in Table 1 are used to infer a and b for the

function of each CR by its Kano's category. Part of the S–CR curve functions is estimated and given in Table 4. The QFD analysis is then applied by building a HoQ. The HoQ of the car interior design is built and will be presented in the near future.

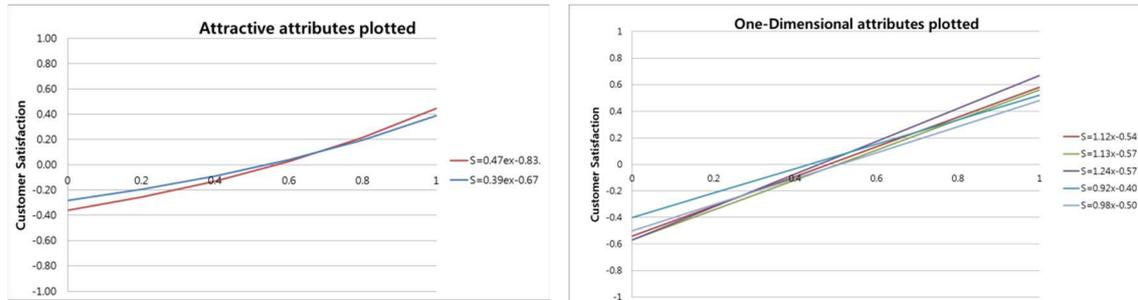


Figure 1. Relationship curves between customer satisfaction and CR fulfillment Table 4. S-CR functions for part of CRs

Customer Requirements	f(x)	S = af(x) + b
Flexible design	-	S=-0.19
Comfortable and Good ergonomics	x	S=1.12x-0.54
User friendly and convenient	e^x	S=0.47 e^x -0.83.
No vibration and noise	x	S=1.13x-0.57
Good safety design	x	S=1.24x-0.57

Research Implications

QFD and Kano's model are two useful tools to enhance the competitiveness of companies by helping them focus on customer needs in product development. The integration of the two methodologies, however, is beset by a range of difficulties including lack of quantitative analysis of Kano's model and limited research on a uniform and quantitative approach to integrating Kano's model into QFD.

A solution to the above two issues is proposed by quantitatively integrating Kano's model into QFD for product design. At first, Kano's model was quantified by the identification of S–CR relationship functions. Then, both qualitative and quantitative results of Kano's model were integrated into QFD analysis. Finally, a managerial analysis performed.

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20.

Differences of Perceived Difficulties by User Groups with Use of a Rehabilitation Robot Prototype

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Abstract

Purpose/ Research Question:

In demographic change, the issue of user involvement draws increasing attention when the design of medical device is discussed. Although usability tests have been adopted for more usable products to various users, no consensus has been reached by experts on the value of the usability tests frequently based on opinions of healthy young men. It means this existing approach is possibly not

sufficient to reflect varied user segments. Thus, this study aims at finding evidence to show the necessity of user diversity in usability issues by comparing perceived difficulties (degrees and spots of difficulties) between three different user groups in using a rehabilitation robotic system.

Key Literature Reviews:

Increasing population of the impaired by aging society and risk society

Derived from the World Health Survey (WHO, 2011), the average prevalence rate of disability in the over-18 adult population is about 15.6%, which corresponded roughly to one billion people across all 59 countries whose population represents 64% of the world population. It was some 650 million people of the estimated 4.2 billion adults aged 18 and older in 2004. Today's environment of 'Risk Society', as Beck(2014) says, raises the number of the impaired by accidents, diseases, war and other unexpected uncertainty of society. Further, these statistics showing a steady increment are expected to continue as the population ages. Demographic transition to aging population is a worldwide phenomenon of the twenty first century. The global population aged 60 years and over was 382 million in 1980, then making more than twice in size, numbered 962 million in 2017, and is expected to double again by 2050, as reaching nearly 2.1 billion (United Nations, 2017). Furthermore, during the same period, between 2017 and 2050, globally the number of the over-80 population is projected to increase more than threefold, rising from 137 million to 425 million (United Nations, 2017). Among countries, South Korea shows an outstanding pace of aging in demographic landscape (Kim, 2018). Its over-65 population of 3.1% in 1970 doubled to 7.2% in 2000, which took 30 years but the number then doubled again to 14.2% in 2017, taking only 17 years (Statistics Korea, 2018). Under the same conditions, this number is projected to 40.1% by 2060 (Kim, Shin, Lim, & Son, 2013). This sharp increase of the elderly population must accompany a big rise of the number of people with impairment of body functions with aging. Eventually, both of the steady escalating tendency of the disabled and the sharp rise of the elderly leads to the new demographic landscape, large growth of the segment of impaired people, which has been poised to become one of the most significant force of social transformations with implications for nearly all sectors of society.

Demographic change and inclusive approach as innovative way

This new normal of the demographic change have the world face unprecedented societal problems but, as the Boserupian tradition argues, mankind will necessarily create new solutions to solve them and on the path of the keys meet by-products called innovation. The greater the population pressure is, the more vigorous the development of science and technological innovation progresses (Boserup, 1976; Simon, 1981). Then, sequentially, this innovative advance spreads out the new perspective into the society at large. Aeon's Senior Shift initiatives under population pressure can be taken as instance. With the expansion of the senior market by super large population of the elderly in Japan,

Aeon, the largest distribution company in Japan, turned up strategies of senior-oriented markets (Aeon, 2012). Likewise, the increasing number of the impaired sends a signal to call each domain for stepping forward and the design community needs to take a preemptive approach as well. Then, it appears a proper start to reconsider the existing way of designing products which has focused mainly on a healthy young man. Today's products becomes more advanced as targeting people without any functional impairments but it seems at odds with the increasing population with impairment (Kim, 2018). When advanced products requiring higher body functions put into the world, people as many as corresponding to demanding functions of the new products are excluded from using or being benefited by them. Linked to this new population pressure of growing number of those with mild impairment neither 'of no disability' nor 'of disability' grows, societal pressure, though currently latent, is poised to compel the design community provide more inclusive surroundings to users in the real world.

User diversity in medical device design

Developing and designing medical devices seem to be placed in a domain which requires this inclusive approach to consider diverse users' usability first. Medical device development during the last decade has seen increased importance of user issues focusing on device design, human error and patient safety (Amoore and Ingram, 2002; Gosbee, 2002; Leape, 1994; Lemke, & Winters, 2008; Martin, Norris, Murphy, & Crowe, 2008; Shah and Robinson, 2006). User involvement and user perspectives, in medical device development, are valuable in that users are the ultimate beneficiaries of such developments, are able to judge and recount problems encountered during they use the devices, and provide a solid rationale for risk avoidance (World Health Organization, 2003). Medical device use errors are not only important in terms of a device to be appropriately re-gearred to users' perspectives (Samore et al., 2004), but are also a common source of preventable patient injury and death (Nobel, 1996; Lin, 1998; Amoore and Ingram, 2002; Baker et al., 2004; Bennett et al., 2005). According to the United Kingdom's National Patient Safety Agency (NHS), many incidents are potentially associated with the design of a medical device (Boakes et al., 2008). Despite the FDA's continuing efforts to inform hazards from a poor user interface in medical devices through revising its Good Manufacturing Practice regulations showing specific requirements for product usability (Food and Drug Administration, 1996) and publishing the series of articles 'Med watch-continuing education' about guidelines for interface design and usability testing, in many cases, medical devices have a poorly designed user interfaces, resultantly difficult to use as inducing a variety of human errors (Zhang, Johnson, Patel, Paige, & Kubose, 2003). These errors lead to incidents where developers fail to correctly understand the use context of their device and to anticipate likely error situations where devices are not designed with users' expectations in mind or where the device does not function as the user expected. Compared to other design areas like consumer products, the approaches weighing users are currently under-used in medical device development (Martin, Norris, Murphy, & Crowe, 2008). "This may be because medical devices are frequently thought

technology driven rather than resulting from an identified un-met need” (Martin, Norris, Murphy, & Crowe, 2008, p280). However, after clinical effectiveness of a medical device is identified, human errors and patient safety remain critically important problems to be resolved, and satisfying user requirements goes far beyond because medical treatment or intervention by the device can be successful under guaranteeing continued use of the device. Meanwhile, depending on the device, users may be comparatively small focusing on very specialized population but over-the counter devices are used by various types of individuals. Simply saying, a very specialized surgical tool can even be used by different individuals with either small or large hands and well-trained professionals or novices. When targeting very specific users to maximize usability in design process, intentional design exclusion to those not targeted occurs. Thus, “it is perilous to assume homogeneity in the user population or for designers to assume that users are just like them” (Weinger, Gardner-Bonneau, & Wiklund, 2010, p7). Designers should accommodate the needs of diverse individuals who have different sizes, shapes, physical abilities, intellectual capabilities, experiences and so on. This exclusion is able to directly be addressed by having a greater diversity of user population. The claim that the needs of multiple types of users should be considered and collected during design is a differentiator in medical devices (Martin, Norris, Murphy, & Crowe, 2008).

Design/ Methodology/ Approach:

With 196 participants (51 UX design professionals, 51 rehabilitation medicine professionals and 94 ordinary people) in total through convenience sampling, a survey was conducted to determine visually perceived ease-of-use, perceived attractiveness and satisfaction in using a rehabilitation robotic system. The apparatus tested in this study was a working prototype of a lower-limb rehabilitation robotic system to provide rehabilitation exercises by letting a patient user perform specific lower body movements.

(Expected) Findings/Results:

The results of the one-way analysis of variance showed a disparity of perceived difficulties between the user groups and indicated the inadequacy of the present usability test, which has focused on single targeted user group. From the regression analysis, the results also identified different preferred features of the robotic system by user groups. Despite the disparity of perceived difficulties between the user groups, the participants noted common preferred features. The features can be adopted for the redesigning of robotic systems and referred to for the designing other products.

Research limitations/ Implications:

Though this approach to reflect user diversity is in its infancy stage, it is also worthy to discuss that this inclusive perspective can create an innovative paradigm through the “use of purposive inflows and outflows of knowledge”, and creates open innovation (Chesbrough, 2006, p. 1). This fresh trial

provides medical device design community with opportunities to rethink conventional usability testing methods and conventional device development process. When considering Whether small and medium sized corporations' conditions whether they will follow this fresh inclusive approach to blend grassroots ideas from various users with their expertise in a reciprocal, responsible and respectful manner (Gupta et al., 2016) is still an open question but some of persistent unmet needs (also referred as wicked problems sometimes) or unaddressed problems of usability for a long time shows that the existing approach is inadequate for the purpose. "Innovations are imperative" (Gupta, Dey, & Singh, 2017). Additionally, though this study also contributes clues for a design guideline for a rehabilitation robotic system, this study has a number of limitations related to the nature of the sample. Hence, there would be the next steps. One would be to discern the effects of user diversity on usability test issues by recruiting a more comprehensive sample and expanding the scope to other medical devices.

Keywords: Accessibility, Medical devices, Perceived usability, Rehabilitation robot, User diversity

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Abstract

Purpose/ Research Question

Jobs are continuously evolving through the coevolution of technology and needs by changing its form only through the Creative Destruction Process, the process where the circulation between creation and extinction continuously takes place. However, the precedent researches on the creative destruction process of jobs up to the present date are insufficient on the research perspectives. Therefore, this research proposes that the jobs are deceased and created through the coevolution between the technology and the human's needs, by the theory of Maslow's hierarchy of needs. As the job paradox takes place during the creative destruction process of the jobs, the research proposes the three safety nets, the safety net of Innovation + the safety net of Jobs + the safety net of Society, as an alternative policy for the government to take into action. Also, the research proposes the virtuous circulation job model that goes through the double ring circulation as a solution to the dilemma of the circulation between the growth and welfare, the issue which the market economy has failed to solve for more than 250 years.

Key Literature Reviews (About 3~5 papers)

Until today, the analysis of the transformation of jobs during the age of the 4th industrial revolution was mainly focusing on the context of the dissolution of existing labor positions and the creation of new jobs. One of the perspectives on the relationship between jobs and technological innovation through the 4th industrial revolution is that innovation will reduce the number of jobs for human workers. For instance, Frey & Osborne announced in 2013, that about 47% of the people of the United States of America would lose their jobs within 20 years from now [8]. Similarly, in 2016, the World Economic Forum reported that within five years, the innovative revolution would create 2.1 million new jobs worldwide, while 7.19 million people around the globe will lose their jobs at the same time. As a result, about 5 million people will lose their jobs throughout the world. Continuously, according to Grace et al.'s study, the artificial intelligence will overcome all of the job abilities of mankind by 50% in the year 2020, and moreover they predicted that the possibility of all of humanities jobs would be automated will be 50% by 2040 [7], supporting the theory of job extinction by the development of technology and the artificial intelligence.

On the contrary to the theory that the jobs will be extinct by the technological development, the researches based on the perspective that the technological innovation called the 4th industrial revolution will create more jobs globally are reported contemporary, which is supporting the theory of job creation through the development of technology and the artificial intelligence. In 2017, the International Data Corporation, or the IDC reported that by 2021, customer relations management (CRM) based on the artificial intelligence technology will create 0.8 million new jobs, while Gartner

forelooked that the artificial intelligence, which is one of the top 10 prospected technologies of the year 2018, will dissolve 1.8 million jobs while creating 2.3 million jobs until 2020. Moreover, on the same year, Mckinsey & Company forecasted that the introduction of automation technology would cause about 75 million to 375 million workers to lose their jobs, which is about 3~14 percentage of the world's working population. However, at the same time, the new demands created by the newly created areas through the automation technology will create 555.5 million to 590 million jobs around the world, in result creating more jobs when compared to the number of jobs closed due to the automatization process caused by the innovation in technology.

Design/ Methodology/ Approach

Jobs evolve through the creative destruction process. This research utilized the Maslow's hierarchy of needs theory to analyze evolution form of the jobs. The Maslow's hierarchy of needs theory divides the needs into the seven hierarchy: physiological needs, safety needs, need for love and belonging, need for esteem and respect, cognitive needs, aesthetic needs, and self-actualization needs. Furthermore, the research draws the three safety net (innovation safety net, job safety net, society safety net) policy, which is based on the Alderfer's ERG (Existence, Relatedness, and Growth) theory, as an alternative solution on solving the job paradox issue, along with the virtuous circulation of jobs model through the double ring circulation.

(Expected) Findings/Results

First finding of the research is the proposal on the formation of job evolution through the creative destruction process during the industrial revolution age by reinterpreting the 1st, 2nd, and 3rd Industrial Revolutions, which are by the Maslow's seven hierarchy of needs theory. By re-analyzing, the former industrial revolutions of the human history, the industrial revolution up to date, the research categorizes the four industrial revolutions into three categories. While the first and the second industrial revolution was the material revolution, where the people sought for the human's desires on survival and convenience, the third industrial revolution is the social revolution, satisfying the human's desire of linkage, or the appetite of to connect and to be connected between each other human beings. The revolution which is currently in progress or the 4th industrial revolution is the liberal revolution, where one's (myself) desire is satisfied, through self-expression and self-realization.

The second proposal is the three safety nets based on the Alderfer's ERG (the three human needs) theory. The three safety nets are the social safety net (the need of existence), the job safety net (the need for relatedness) and the innovation safety net (the need for growth). Also, the research proposes the virtuous circle of job model through the double ring circulation.

Lastly, the research proposes flexibility between job and work, regulatory reform, virtuous cycle ecosystem, innovative safety net policy and re-education system, capability matching platform,

job safety net policy, smart welfare (efficiency through artificial intelligence and transparency through blockchain), smart lifelong education, and the social safety net policy.

Research limitations/ Implications

The implications of the research are establishing the job focused fourth industrial revolution inclusive growth policy making by providing the virtuous cycle on the job policies as the point of view to the policymakers.

(1,010 words)

Keywords: Creative Destruction Process, Job Evolution, Job Paradox, Virtuous Circulation Job Model

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22.

The 4th Industrial revolution and Smart transformation

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Abstract

The 4th industrial revolution is the revolution where the off-line world and the online world are converging into the data. Therefore, this research intends to propose the fusion process of the real world and the virtual world through artificial intelligence along with other 12 technologies, or the AI+12 technologies, through the 4-Step Phase Smart Transformation Model. The 12 technologies of the AI+12 technologies are Internet of Things, Location Based Services, the Cloud platform, Big Data, Internet of Biometrics (or Wearable Internet), Social Network Services, Cyber-Physical System, 3D Printing+Robots, Augmenter Reality + Virtual Reality, Blockchain + FinTech, Gamification and the Platform technology. The AI+12 technologies, which realizes the smart transformation, is consisted of the six digital transformation technologies which transform the reality to virtualization, and the six analog transformation technologies which realize the virtual world, and with the artificial intelligence that connects all 12 technologies. This research proposes to call the technical model as the AI+12Tech Model.

The convergence of the real world and the virtual world through 13 technologies(AI and Twelve Technology) go through the four-step phases. The first step is making the data of space and humankind through the Internet of Things, Location Based Services, Internet of Biometrics, and the Social Network Services. The second level is establishing the big data through the cloud platform, and producing the digital twin, which correspondences with the reality on one on one. The third step is creating the optimized value by prediction and customization through the artificial intelligence on the base of the big data. These three step is called digital transformation by moving reality to the virtual world. Moreover, in the fourth phase, actualized the human's desire and needs by realizing the values created on the 3rd level. In this study, the process of making a virtual reality is defined as an analog transform. And a smart transform is combined digital transform and analog transform

Among the 4 level phases of the smart transformation, the utilization of digital transformation that enables datafication, informatization, and intellectualization as the follower in the technology development. Also, as the analog transformation technologies of the smartification are blue-ocean, the late starter needs its development strategies. Especially the technologies of digital transformation, which creates data from the relationships and the factors of the time, space and humankind by Big Data, the Cloud Platform, Internet of Things, Location Based Services, Internet of Biometrics, Social Network Services, was the generic technology of the 3rd industrial revolution. However, realizing humanity's desires and needs takes place by the technologies of the analog transformation, which is the technology brought into life by the 4th industrial revolution. The analog transformation technologies are Cyber-Physical System (or CPS in short) design for designing the desires and needs of mankind, 3D Printer, Augmented Reality (AR for short), and Virtual Reality (VR for short) for realizing the desires, FinTech and Blockchain for trading desires, Gamification for continuing desires, and the platform for sharing desire and needs. Therefore, the conduction of entrepreneurship, which is the innovative leadership that finds out the unsatisfied needs of humanity and solves it through technology.

This research will go on a case study of the 4-step phases Smart Transformation Model by focusing on the ecosystem established by the global unicorn's platform businesses. Through this method, the research will demonstrate the smart transformation model by proving that smart transformation is possible in every field by using AI+12 Technologies. The research will give implications to the authorities in charge of making policies related to industries and its related fields attempting for innovation, as this research proposes a detailed alternative as the first study around the world.

Keywords: Convergence of Real World and Virtual World, Digital transformation, Analog transformation, Smart transformation

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23.

A Repository Architecture for the Start-up Business Process

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Abstract

Purpose/ Research Question

Most Preliminary entrepreneurs don't have any experience about managing startup. It is important for them to know business process and knowledge of their company in order to manage a company successfully. Nevertheless, they have trouble understanding process of their company and finding information when they perform business process. Recently, many web sites that help information for startup appear but they are not considering in terms of entrepreneur. To solve this problem, in this paper, it purposes the start-up business process repository architecture that provide meaningful management information data for successful startup.

Key Literature Reviews (About 3~5 papers)

The three important factors, that directly affect the performance of new venture creation, are human resource, physical resource, and opportunity. In order to maximize the performance, an appropriate combination of these factors is required, which could be achieved through systematic management

[1]. Moreover, insufficient resources and absence of networks with external stakeholders are the some of the reasons why startup companies face difficulty in surviving the competition with existing companies [2].

Research on the factors necessary for startup operations has seen much progress. However, there is paucity in the study of how startups should be operated during startup operations. Entrepreneurs consider entrepreneurial activity like black boxes: where the inputs and the outputs are measured with limited attempts to understand how the black box operates [3]. EA, enterprise architecture, is used as a holistic approach to keep things aligned in a company. Some emphasize the use of EA to align IT with the business, and others view it from a broader perspective and use it to also keep the processes aligned with the strategy. EA is a key instrument in controlling the complexity of the enterprise and its processes and systems. The four dimensions of Why, Who, How, and What can be used as a basis of an approach for EA in SME [4].

Entrepreneurs or small and medium-sized company executives are interested in the “Know How” to utilize the resources that are required for company management [5]. However, they could solve the problems as long as they know where and to whom the required resources for startup companies are available, rather than what to make and how to make. Even though “Know-How” is important to operate the startup company, resource management is identified to be an important factor as well from the viewpoints of “Know-who” and “Know-where.” The three important factors that directly affect the performance of the startup company are the team, resources, and opportunities [6]. In order to maximize the performance, appropriate combination of these factors is required, which could be achieved through systematic business process management [7].

One of the most representative works of the Process Repository is the Process Handbook Project, which was held at MIT's Center of Coordination Science for seven years. The purpose of the Process Handbook began to redesign existing business processes, develop new processes, and share processes with corporate members. First of all, this study collected about 5,000 different processes in various companies. Then, the collected processes are classified according to the process classification standards developed by various organizations. They also developed a tool to classify the collected data according to the process classification [8].

The BP Model Repository management model consists of three parts: the process data model, the process function model and the process management model. Each model contains sub-models, which are further divided into elements. The process data model defines the types of business process models and related data that can be stored in the BP Model Repository. It consists of Meta model, Presentation, Storage model and Index model. The meta model defines the information that can be stored in the BP model storage and the information that can be stored by defining the relationship between the concepts used in storage and their concepts. A BP Model Repository should support a series of basic functions to effectively manipulate the processes that it stores. We identify storage functions, retrieval functions and integration functions. Advanced management

functions can be subdivided into functions that are provided by general repositories and functions that are provided only by BP Model Repositories [9].

Design/ Methodology/ Approach

In this study, we proposed a meaningful business start-up business process repository concept that (start-up) executives could refer to. The preliminary founders were able to get a preliminary understanding of the related tasks required for the start-up from the repository, so that they could contribute to the long-term development of start-up. In particular, the system architecture was constructed considering the functional elements required for the above goals. Also it provides best practices among the information related to the start-up management process. In particular, we take advantage of Entrepreneurial Business Process Notation (EBPN), which is easy to understand, since many founders lack expertise in business processes. Furthermore, it uses a classification system to efficiently manage the stored contents and to make it easier for preliminary founders to find the startup cases they want.

(Expected) Findings/Results

The architecture for Startup Business Process Repositories can be divided into the following five layers.

- Startup Process Notation Layer: It provides an Entrepreneurial Business Process Notation (E-BPN) that allows users (startup) to interact with the Business Process Model repository, allowing start-up to easily interact with the functionality provided by the repository.
- Startup Process Repository Management Layer: It provides both the specific repository functionality and functionality provided by the general repository.
- Startup Database Management System Layer: It provides functions that are generally provided by database management systems.
- Startup Process Storage Layer: BP model stores process models, related data and indexes or classifications that enable quick query, search, and search of repositories.
- Startup External Tool: Start-up Process Provides tools and tools that can be utilized by actual start-up using repository data.

Another important component in the architecture is the interface. Interfaces between each layer allow interactions according to the internal format of each layer.

- Startup Process Repository Interface: This interface connects the Startup Process Repository Management Layer and the Startup Process Notation Layer, and links the information derived from the repository management to provide a GUI form.
- Startup Process DBMS Interface: This interface connects the Startup Process Repository Management Layer and the Startup Database Management System Layer. It provides a

connection for analyzing the data managed by DBMS through repository management.

- Startup Process Storage Interface: This interface connects the Startup Database Management System Layer and the Startup Process Storage Layer. It connects the underlying data storage system to the DBMS.
- Startup External Interface: It provides an interface between the Startup Process Repository Management Layer and the Startup Process Notation Layer for using tools and tools that start-up can utilize.

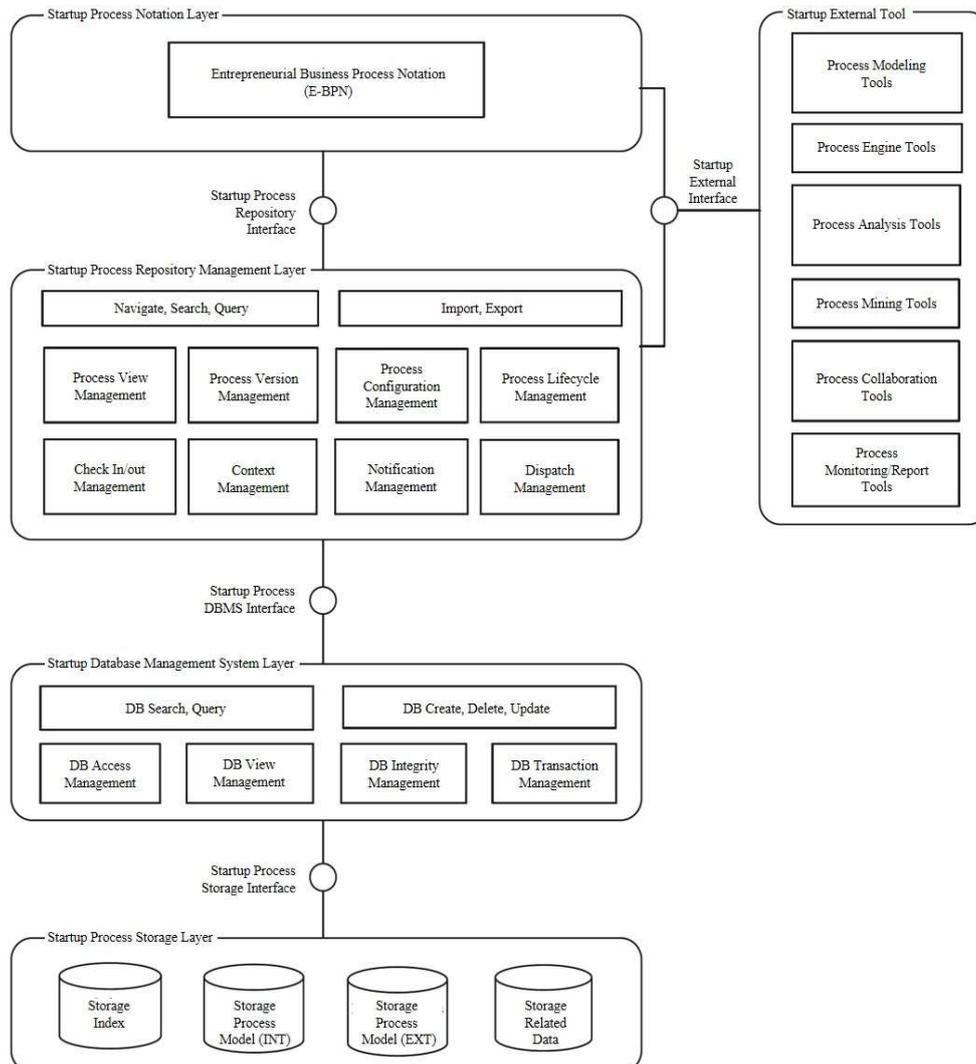


Figure 1. Example of Start-up Business Process Repository Architecture

Research limitations/ Implications

Start-up is not enough to establish internal processes, and management is not specified and causes confusion in business. This is one of the reasons for typical start-up failures, and business processes are considered necessary for long-term business management, but in reality, the majority of

entrepreneurs have limitations in identifying them or acquiring relevant knowledge. In this study, we proposed a meaningful start-up process repository concept that (start-up) executives could refer to. The preliminary founders were able to get a preliminary understanding of the related tasks required for the start-up from the repository, so that they could contribute to the long-term development of start-up. In particular, the system architecture was constructed considering the functional elements required for the above goals. It is expected that it will be able to manage business processes in a start-up company that start or start a startup business efficiently in one place and provide ideas about what business process can be additionally performed according to the start-up stage.

Keywords: start-up business process, process repository, process data model, process function model, process management model

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Public Service Motivation and Attitudes toward Sustainability

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<Abstract>

This study seeks to explore the link between public service motivation (PSM) and sustainable environmental orientation. PSM such as interest in public issues, community service, consideration for neighbors, and self-sacrifice are expected to have a positive impact on sustainable environmental conservation. We introduce several research hypotheses about the relationship between PSM and sustainable environmental orientation. The higher the motivation for public service, the more interested in environmental issues. The higher the motivation for public service, the more likely it is that it will take its own damages to preserve the environment. The higher the motivation for public service, the more consideration and attention will be given to the surrounding environment. The higher the motivation for public service, the more the environmental problems surrounding the community will be viewed from a long-term perspective than from the short-term perspective. This study will use comparative surveys of college students in Korea, China and the United States. We will try to empirically analyze the above-mentioned research questions based on comparative research methodology and regression analysis.

Keywords: PSM, Sustainable Environmental Orientation, Long-term Time Preferences, Public Interest, Compassion, Self-sacrifice, and Attraction to Community

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25.

The Effects of Technology Entrepreneurship on Employment Change

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Abstract

Purpose/ Research Question:

Klaus Schwab, chairman of the World Economic Forum, warned that in the fourth industrial

revolution era, 7.1 million jobs worldwide will disappear over the next five years (World Economic Forum, 2016). An ironic phenomenon has emerged in which technological entrepreneurs and venture companies, which are expected to create jobs, are driving the industrial revolution, leading to a profound decline in jobs. Will technology start-ups create jobs as much as the government expects? In this regard, new technologies in a wide range of fields such as artificial intelligence, robotics, the Internet, autonomous vehicles, 3D printing, nanotechnology, and Quantum Computing warn that most of the existing jobs will disappear because of the replacement of our jobs. (Autor, 2015), which exaggerates and estimates the alternative size of labor in these claims, and re-invokes other forms of labor demand.

The purpose of this study is to find the answer through the analysis of actual data. In order to verify whether there is a difference in employment creation performance between technology start-ups and general enterprises and to verify whether the technology start-up support policy is valid by examining whether the technology start-up business affects the quantitative aspect of employment. For this purpose, this study examined prior studies on entrepreneurship, employment, technology entrepreneurship and employment, and defined the concept and scope of technology entrepreneurship for specific analysis. For the quantitative analysis for the purpose of the study, statistical data including information on technical entrepreneurship information, average employment number and new recruitment number among the national approval statistics were collected and analyzed.

This study has the following differences in research method in order to contribute to the theoretical development. First, in defining the scope of technology start-up companies, we did not classify them as the same as the previous researches but embody the scope of the actual technology start-up enterprises by including the companies whose average intangible assets ratio is above average. In addition, the three-way analysis of employment was made possible by comparing the average number of employees with the number of new recruits. Finally, the figures for employment are adjusted to sales to sales to eliminate the effects of the company's sales. Through these researches, we tried to derive some practical implications for technology startup support as ultimately unemployment countermeasures.

Key Literature Reviews

The empirical analysis of the effects of entrepreneurship on job creation can be divided into two groups: positive and negative. The results of this study are as follows: First, the study found that start-ups have a positive effect on job creation. . Acs & Mueller(2008), Thurik et. al.(2008), Fritsch & Mueller (2008) and others. However, the study by Cho(2014) and Stel & Storey (2004) showed that the start-up does not have a significant effect on employment.

For example, Fritsch and Mueller (2008) used statistical data from Germany to analyze the effects of the rate of entrepreneurship on the employment growth rate. Similar research has been

conducted in Korea, and Lee(2009) analyzed the relationship between entrepreneurship and employment by using similar research methods. The results of this study are as follows. First, we analyze the data of the region in Korea and confirm that the entrepreneurship activities of the entrepreneurs such as USA and Germany contribute positively to job creation. As with the study by Fristch & Mueller (2008), it was found that the effects were influenced by the time lag. The results of this study are summarized as follows. First, the effects of employment change on direct and indirect effects are examined.

Unlike studies on economic growth, most studies on employment have drawn many conclusions. Decker et al. (2014) note that although start-ups and relatively low-skilled firms make a significant contribution to job creation and productivity, many early start-ups fail to contribute to job creation. In addition, Acs & Mueller (2008) investigated the relationship between entrepreneurship and employment in the United States and argued that most of the job creation effects occurred within one year. In Korean studies, Cho(2014) argues that high start-up rates do not bring about high employment performance, but rather high-performance firms are likely to achieve high employment performance.

In addition, although the influence of entrepreneurship on employment is not negative, research has also been conducted on other approaches to unemployment. Thurik et al. (2008) analyzed the 'refugee effect' in which the high unemployment rate leads to start-ups and the 'entrepreneurial effect' in which unemployment decreases due to the increase in entrepreneurial activities.

The main research on entrepreneurship and employment is the analysis of the impact of high start-up rates on employment rates (Lee, 2005; Fristch and Mueller, 2004).

The dynamic analysis model of entrepreneurial effects, which started from the study of Audretsch and Fritsch (1996), was fully reflected in the analysis of employment effects by Fristch and Mueller (2004). According to this, the employment effects of entrepreneurship are the direct effect, which is the effect of employment growth, the displacement effect, which refers to the stage of restructuring of employment caused by the entry of entrepreneurship, and the effect of the employment inducement that leads to the expansion of employment. Although dynamic research on the impact of entrepreneurship on employment has important implications, it has limitations in securing methods and data for measuring long-term effects. Therefore, it is analyzed with various variables based on existing theoretical hypotheses. In the case of technology entrepreneurship, the term entrepreneurship is added to the concept of technology or technology innovation. The method of analyzing technology entrepreneurship, which includes the concept of technology or technological innovation, which has a complex mechanism with entrepreneurship, becomes more detailed and complicated, and it is difficult to try to generalize it by recognizing the validity of the analysis result. Therefore, an in-depth understanding of existing research should be preceded.

Research on the impact of technology startup on employment largely focuses on two perspectives. One is to focus on a similar topic to the study of existing entrepreneurship and employment, such

as the size of influence of technological entrepreneurship on job creation and time lag, and the other is to focus on the difference between technology entrepreneurship and general entrepreneurship.

Lee(2011) used the basic statistical data of the business to identify the impact of the start-up on the employment by short-, medium-term, and long-term. The dynamic effects of the Almon polynomial lags estimation method used in the study of Audretsch and Fritsch (1996) and Lee(2009) were analyzed. As a result of analysis, direct, substitution, and incentive effects over 10 years were confirmed, and the differences between manufacturing and knowledge service industries were analyzed.

As a result, knowledge service industry has higher employment generation ability than manufacturing industry, knowledge service industry has direct effect, and manufacturing industry has higher incentive effect. In addition, the analysis by technology level showed that high technology firms contributed to employment decrease, middle industry firms contributed to increase of employment, and low technology firms did not contribute to increase of employment. In addition, compared with previous foreign research results, it was argued that SME support policy was the reason that the time taken for start-up firms to substitute for existing companies or lack of competitiveness to exit the market was longer than that of developed countries. In addition, I pointed out that the impact of entrepreneurship on employment has a great influence in the short term, but it has a minor effect in the long run. The study results of Kim et al. (2011) show that the relationship between the domestic rate of growth and the employment rate can be examined in detail. In addition, we can confirm that the study of the impact of entrepreneurship should focus on short - term effects.

In addition, research by Kim et al. (2015) has focused on the difference between technology start-ups and general start-ups. A company with a certain level of technology or more is defined as a technology startup and the change in the annual average employment growth rate is used to identify the factors contributing to job creation by the technology startup. Technology entrepreneurs have differentiated their R & D intensity and intangible assets by organizing concepts based on NTBFs (New Technology-Based Frims) widely used in foreign countries. We have identified how the annual average growth rate of employment of technology entrepreneurs is different from that of other entrepreneurs. As a result, employment growth rate of technology start-up firms was high and statistically significant. In addition, the regression analysis of job creation confirmed whether it was a technology entrepreneur, whether it was located in the Seoul metropolitan area, and whether financial assets were secured.

In addition, there are many studies on the dynamic changes that lead to short-, medium-, and long-term studies. In contrast, research on the size and characteristics of employment created directly by technological entrepreneurs The research of this study is actually lacking.

Design/ Methodology/ Results

1) Research hypothesis

(1) Verification of differences

First, the quantitative aspects of employment are as follows. In the study of Kim et al. (2015), it was confirmed that the annual average increase rate of employment of technology start-up enterprises is higher than that of other start-up enterprises. In addition, research on the relationship between technological innovation and employment, which is a representative characteristic of companies founded by technology entrepreneurship, and that employment is created in all categories of innovation activities. According to a study by Lee and Lee (2017), the total employment rate of the knowledge-based manufacturing industry and knowledge-based service industry, which are included in the category of technology startup, is higher than that of other industries. And that other industries are likely to reduce employment.

As can be seen from the point of promoting the technology start-up support policy of the government, it is recognized that technology companies have employment-friendly characteristics such as solving unemployment problems and creating jobs. Therefore, the following hypothesis was set based on the results of this study and the recognition.

(H1) Technology companies will have a higher salary to sales ratio than general companies.

(H2) Technology companies will have a higher recruitment rate than general companies.

(2) Regression model verification

In this paper, we propose a new type of job creation system, which is based on the concept of entrepreneurship, that is, the creation of jobs. The results of this study were based on the analysis of the relationship between the employment rate and the establishment rate. The common feature of these research results is that the effect of the rate of entrepreneurship on the employment rate is proven to have a positive effect in the first 1-2 years. Of course, the opposite claim can be confirmed. Cho(2014) argues that high entrepreneurship rates do not lead to high employment performance, and that firms with high performance are likely to achieve employment performance. The results of the research and the results of the previous researches such as Lee et al. (2011) and Kim et al. (2015) gave many suggestions on the composition and progress of this study. The results of the study by Dong-ju, et al. (2011) show that high-technology firms contribute to employment decline. In the study of Kim et al. (2015), the result is that the annual average increase rate of employment of technology start-up companies is higher than that of other start-up enterprises. Although the results of the two studies are not exactly conflicting, it is necessary to ascertain the differences between the technical start-up pie and job creation criteria of this study. The following hypothesis was set up in light of the government's policy that technical venture business as a result of such prior researches is the main solution to job problems such as job creation.

(H3) Whether technology entrepreneurs will have a positive impact on the quantitative aspects of employment.

2) Result

The results of the hypothesis tested through the difference verification and regression model analysis are summarized as follows. Hypothesis 1 that technology firms have higher salaries to sales than general firms is higher than that of general manufacturing industry and general service industry, and has a high average value. However, in the case of new recruits, the general service industry was higher than the technology industry. Therefore, Hypothesis 2 was rejected. Regression analysis of the effects of technology startups on the quantitative aspects of employment, in particular, on the sales to employment volume, could not confirm the expected impact of our estimates as the significance level deviates from the significance level.

Research limitations/ Implications

This study focuses on the approaches of prior studies to examine the characteristics of quantitative aspects of employment creation of technology start - ups. In order to investigate the quantitative aspects of job creation, we focused on the difference in employment creation according to the characteristics of the company by controlling sales, which is the biggest influence factor, and conducted a short-term performance analysis on job creation of start-up companies . This study used the data of business panel survey published in March, 2018 to analyze the employment data created by companies directly, and the following analysis results were derived.

First, we divide the firms into technology companies, general companies, start - up companies and existing ones, and confirmed whether there are significant differences in the number of employees and the number of recruits compared to sales. Technological firms were found to outperform the quantitative aspects of employment, in particular, employment, compared to general manufacturing in the general manufacturing industry or the private sector. In the case of the public sector, which is difficult to compare due to the nature of the variables such as the number of employees versus sales, technology companies are the most employment-friendly. On the other hand, the number of new recruits compared to sales showed a high level in the general service industry, reflecting the characteristics of the general service industry with many part-time and non-regular workers. The high number of newly hired employees with low indicators of employment retention is unlikely to be a positive signal from the quantitative aspect of employment. Therefore, it can be confirmed that the quantitative employment creation performance of the technology companies generated by the technology entrepreneurs is superior to those of the other industries.

Second, the analysis of the effects of technology start-up on sales-to-sales volume did not reveal any significant effect.

It is necessary to confirm the difference and the difference in the interpretation of the results of this

study. This study examined the short - term effects of jobs created by technology start - up companies and used variables such as the number of hired employees versus sales, and the number of hired new employees rather than general job creation. Therefore, it should be noted that it is simply interpreted as the effect on the employment according to the classification of the start-up company or the job creation result according to the business classification. In conclusion, technology start-up can be recognized as a key tool for quantitative employment creation and higher performance can be expected in terms of continuous employment rather than short-term performance.

There is a need to think about the jobs created by technological entrepreneurship and the employment problems caused by the fourth industrial revolution, which is a recent issue. We are witnessing artificial intelligence doing a great deal of work that I thought was already creative, and humans are looking for tasks that require a higher level of creativity that artificial intelligence can not solve. In this regard, the results of this study suggest that technological entrepreneurship, which should be emphasized continuously for our competitiveness, is creating stable and high quality jobs. Due to the development of the digital platform, small-scale start-up companies such as one-person enterprises actively participate in the market and are included in the category of important technology start-up. However, due to the characteristics of the business panel survey data selected in this study, The deviation of sales and employment data, which are included in the analysis, are the limitations of this study. In the future, it will be meaningful to complement this and further analyze the employment of industry groups related to the 4th Industrial Revolution.

Keywords: Technology Entrepreneurship, Technology Innovation, Employment Change

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**A Study on the Effects of Entrepreneurship Education on Occupational Choice
- Mediating effect of Bricolage**

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Abstract

The purpose of this study is to examine the effect of entrepreneurship education on occupational choice of engineering students. The purpose of this study is to examine the influence of Bricolage on students and to propose diversity in the selection of college students through entrepreneurship curriculum. For this study, we examined the effects of entrepreneurship, bricolage, and occupational choice. As a result, entrepreneurship was found to affect occupational choice, entrepreneurship had a significant effect on bricolage, and Bricolage had a significant effect on occupational choice. It also confirmed the mediating effect of Bricolage on entrepreneurship and occupational choice. As a result of this study, I would like to suggest some implications for the importance of entrepreneurship education for college students through Bricolage.

Key Word : College engineering students, Entrepreneurship, Bricolage, Occupational choice

Introduction

Korean college students prefer large corporations and public enterprises because they want to work environment, social recognition, and regular employment. This makes it difficult to find talent in small and medium-sized enterprises (Park, 2017). In order to solve these problems, it is suggested that entrepreneurship education that can enhance the challenge, creativity and innovation to young people is needed. However, many resources, such as their own human resources and technical resources, are not available, and resources and opportunities are often not available. This is a waste of resources and can also result in a further shrinking of the domestic employment market. In this regard, entrepreneurship education can have a significant impact on employment in terms of quantity and quality of work (Hwang & Jeon, 2010). The purpose of this study is to provide opportunities for new occupational choice through entrepreneurial mindset through entrepreneurship education for engineering students.

The purpose of this study is to investigate the effects of entrepreneurship education on occupational choice and to examine the influence of Bricolage on various occupational choice of college students.

Theoretical background

1. Entrepreneurship

Entrepreneurship is defined by different generations of scholars. McClelland(1965) refers to the tendency of individuals to challenge appropriate risks, Stevenson(1990) defines opportunities to pursue opportunities regardless of the resources they currently hold, Hisrich & Brush(1990) argues for risk-taking and value creation as a process of creating something of value based on risk and its rewards. Timmons(1994) defines opportunities, inferences and behaviors based on holistic approaches and balanced leadership, focusing on opportunity. Bae and Cha(2009) define the way of thinking and behavior that capture and pursue opportunities regardless of the resources or abilities they possess.

Drucker(1985) argues that entrepreneurship is a fundamental reason for solving many of the economic and social problems that arise in the existing economy because entrepreneurship has essential characteristics that can change people's values and attitudes. Lee and Kang(2016) define entrepreneurship as an important concept for all, including the general public as well as stakeholders and experts. Lee(2014) defines entrepreneurship as 'self-innovation that creates value and usability' while explaining that entrepreneurship is the core concept of solving the problems of the age is entrepreneurship. Entrepreneurship can be defined as the process of transforming an artist into an end product through the process of acquiring intellectual property rights and integrating it with economic innovation or new market value as a creative result(Kim and Jung, 2015).

Shin(2016) said that entrepreneurship seeks opportunities in their lives and creates new values for the future, Recognizing entrepreneurship has focused on evaluating entrepreneurial skills and attitudes and choosing decisions about their future profession(Linan, 2004).

Yang(2014) said that promoting entrepreneurship based on entrepreneurship education is an essential requirement for economic growth of the country, Luthje & Franke(2002) Based on the results of the survey on entrepreneurship education, American students showed strong interest in high technology start-up after graduation, Gibb(2002) argues for entrepreneurship and entrepreneurship education to approach the new paradigm and argues that different stakeholders should maximize opportunities to learn and learn from a wide range of perspectives. Kim(2013) mentions the importance of career education as well as entrepreneurial spirit because entrepreneurship has an important influence on growth and personal happiness as a member of society even if they do not start up with personality, habits and ability(Kim, 2006).

Park(2014) entrepreneurship education should be addressed not only to the individual's economic capacity and career but also to the local and national perspectives. Entrepreneurship education should be organized not only for individuals and corporations but also for social and national systems. It should be conducted through school education and activities. It should be possible to make entrepreneurship education an essential common process to coordinate the establishment-friendly recognition during the undergraduate course and to select students in various ways after

graduation(Kim, 2013). many countries have focused on entrepreneurship in economic and social growth(Venkataraman, 1997: Black, 2006; Luca Ferri et al., 2018).

2. Bricolage

The term bricolage was first created by Levi-Straus(1967) as 'making whatever it is possible to do anything', which includes physical artifacts, techniques or ideas(Baker and Nelson 2005). Bricolage does not follow the standard and standard practices originally intended for these resources, but rather a bias to the task of distributing and integrating resources in new ways(Baker and Nelson, 2005).

bricolage refers to the choice of occupations in a wide range of possible jobs, Baker and Nelson(2005) describes this as "applying a combination of resources close to new problems and opportunities"(Fisher, 2012). Fisher(2012) When faced with a new challenge for entrepreneurs, I explained with three choices: first, to look outside the enterprise; second, to avoid uncertainty and miniaturization; third. Bricolageization by applying new problems and opportunities through a combination of resources. Collins(2001) defines bricolage in terms of its ability to look at its own resources in order to secure human networks and networking, and to extend them through a kind of linkage of resources.

Baker and Nelson(2005) define bricolage as the ability to achieve the goal by maximizing the potential use of potential resources around it, Jaeger(2007) suggests ways of solving the shortage of internal resources through human networks and internet networks, Lee & Bang(2013) Based on the material resources possessed and the experience of knowledge embodied, additional resources are procured through the social network that can be constructed or utilized by oneself. Baker & Nelson(2005) refers to the ability to combine skills, ambiguity, confusion, frustration, and the ability to utilize improvised resources and opportunities for creativity in their bricolage capabilities.

Tina Richardson (2017) Bricolade claims to be "a creative act as a methodological formation act through creative action or re-expression."

3. Occupational choice

According to the Social Cognitive Theory, human behavior is motivated and controlled by continuous action that has its own influence(Bandura, 1991). The career decision of Korean young people will appear in the form of major selection when they go to high school and college, (Hwang, 2007). The motivation for choosing a career is largely divided into individual self-realization, independence pursuit, role model pursuit, financial achievement and innovation pursuit(Carter, 1997), The motivation for choosing a career is the individual's inner state of mind that makes it behave for the purpose of the career that it wishes to accomplish(Owens & Valesky, 1995).

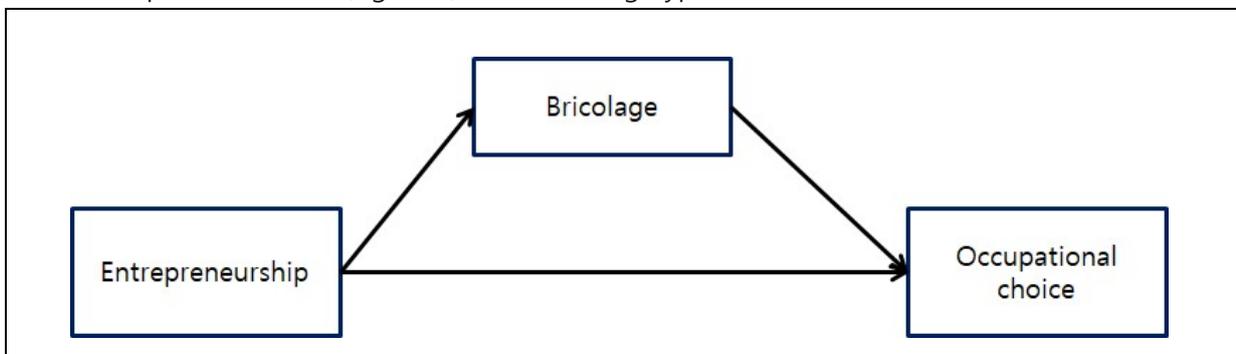
Holland(1985, 1992) suggested six types of occupational choice: six types of occupational, social, persuasive, artistic, inquisitive and realistic are personal physical characteristics and home environment, Are formed by acting in combination. Occupational choice are developed by preferences that refer to values and values, and by personality that speaks intrinsic control,

achievement desires, and patience(Kim, 2013).

Lee(2013) As a part of the occupation, the students 'understanding of entrepreneurship and the motivation of the students' occupational choice motivation and the entrepreneurship motivation have positive effects on the self-efficacy of entrepreneurship, It is important to identify the motivation of occupational choice motivation for students receiving entrepreneurship education and to clarify the relationship between entrepreneurship intention and the future of entrepreneurship education. It is necessary to grasp the motivation of the occupational choice motivation that young people have and to decide the course (Lee, 2013).

Theory and Hypothesis Development

In this study, we investigate the effect of entrepreneurship education on the occupational choice of college students, and to investigate the influence of Bricolage on the entrepreneurship education and occupational choices(Figure 1), The following hypotheses are derived.



<Fig 1> research model.

1. Entrepreneurship and Occupational choice

Ardichvili et al.(2003) found that the ability to express the personal interest and the capacity of management knowledge to perform various tasks maintains the development and sustainability of entrepreneurship, Kirkwood et al.(2014) argue that the value of the curriculum for entrepreneurship is to improve self-confidence, to build entrepreneurial knowledge and skills, to develop a sense of realism and the ability to discover practical solutions. Suggesting ideas and networking these values may also be applicable in occupational choices beyond entrepreneurship, Lee and Kim(2015) There is a statistically significant relationship between entrepreneurial knowledge job conductivity and entrepreneurial intention, Kim(2014) has a positive effect on the occupational value factor and entrepreneurial intention And the type of occupational personality has a positive effect on the will to entrepreneurial intention. Entrepreneurship riots can be systematically recognized to solve the problems of economic progress(Kim and Lee, 2018). Sim & Lee(2015) Entrepreneurship has been shown to be strongly related to occupational groups, entrepreneurial orientation, personal competence (characteristic) occupational value, entrepreneurial characteristics, motivators of occupational choice, environmental factors, home environment, entrepreneurial factors,

entrepreneurial intention, Lee(2013) In this study, we examine the relationship between the motivation of occupational choice and the relationship between the motivation of the students and the willingness to start a business, Alan and Malin(2011) can have important effects on occupational choice and future hopes as well as individual college life decisions in career decision making and can be important in predicting entrepreneurial intentions, Lee(2007) argues that entrepreneurship is based on occupational choice and that the total combination of individual productive values and resources will have a long-term educational and household production context. But if you look at the negative effects rather than the positive ones, Ha(2011) showed that reputation and support from the periphery had a negative effect on the preference of SMEs in the employment selection factor, Kim and Knag(2016) Entrepreneurship education has a negative impact on job seeking attitudes. The following hypothesis was derived through this study.

Hypothesis 1: Entrepreneurship Education will affect occupational choice.

2. Entrepreneurship and Bricolage

Baker & Nelson(2005) Bricolage is used to link entrepreneurship education to entrepreneurship level start-up activities, and individual growth and development through entrepreneurship education are relevant to educational applications, A powerful way to develop entrepreneurial skills, entrepreneurial identity, and entrepreneurial behavior to develop by creating value for students(Williams, Middleton, 2013; Lundqvist et al., 2015), And can be a powerful way to develop entrepreneurial ability, entrepreneurial identity, As a method, effectuation, bricolage, design thinking, and Lean start-up are recognized as new methods that can be applied for educational purposes that promote value creation(Sarasvathy , 2001). Using the resources, local knowledge and small support networks derived from Levi-Strauss(1966) Bricolage has subsequently been influencing entrepreneurship as a theoretical framework for understanding entrepreneurial activity (Baker & Nelson, 2005), Francesca & Mirella(2014) Sees another research area of art entrepreneurship to be associated with entrepreneurial bricolage and entrepreneurial bricolage on how to create something using limited resources is particularly interesting in the arts. Merie & Mari(2016) observed the entrepreneurship and Bricolage through an in-depth analysis of the cooperation between the University of Finland and Indian social enterprises and found that faculty, students, founding mentors and college resource groups developed solutions when marketing resources were scarce And it was used as a mechanism of poisoning. Francisco(2017) Examined the effects of entrepreneurship by significantly enhancing entrepreneurial potential as a result of an ex post facto survey of entrepreneurial potential with entrepreneurship and Bricolage theoretical approach to college students, Lin & Nabergoj(2014) Bricolage has been chosen as a viable path because entrepreneurship and the use of available resources to create new things in Bricolage's research are simply due to the lack of other feasible resources and resource constraints promote corporate

creativity. David Crouch (2017) suggests that the concept of bricolage has been "reinterpreted in social anthropology and geography, not only in terms of potential at the time, but also in a new interpretation of the processes and customs of recent critical interest in a wide range of fields, particularly in culture" .

Entrepreneurship education and Bricolage have been used to solve the problem of resource shortage. They have developed marketing strategies for venture companies, improved knowledge on developing marketing strategies for social enterprises, contributed to the acquisition of social entrepreneurship education and social enterprise resources, Given that both business and self-employment involve risks during crisis periods, Individual occupational choices can avoid relatively risky employment(Kannampuzha, 2016). The following hypothesis was derived through this study.

Hypothesis 2. Entrepreneurship Education will have a positive impact on Bricolage.

3. Bricolage and Occupational choice

The new entrepreneurial behavior theory is the bricolage of entrepreneurs and the term "bricolage" is derived from French and means "do-it-yourself" (Baker and Nelson, 2005). bricolage defines the beginning of a start-up in a range of possible jobs And Baker & Nelson defines it as "a combination of new problems and resources that are close to the opportunity" (Fisher, 2012).

Baker and Nelson(2005) introduced the concept of diversity, introducing bricolage beyond financial capital and argued that entrepreneurs(small and medium-sized enterprises) can be applied to new problems and carry a unique combination of new types of resources. It serves as Bricoleur by presenting new solutions in pharmaceuticals and operating them as available resources. Bricolage can involve a variety of resources if it is responding to resource shortages. For example, a founder may use a variety of resources including suppliers, office space, funding, consulting and employment(Baker et al., 2003), Eftychia et al.(2015) Bricolage effectively reverses the flow of processes and can be viewed as other types of resources, such as technology, equipment, land, and buildings, as well as individuals who own human, social, and financial capital, and tend to invest heavily in new or re-startup. Psychological perspectives show that entrepreneurial occupational choices are more likely to be "planned" or "as intentional" based on individual motivation, psychological composition While the economic and sociological model for rational choice sees occupational choices as maximizing entrepreneurship as an individual's social or economic utility(Evans & Jovanovic, 2007).

Sarasvathy (2015) argues that training a potential entrepreneur to take preemptive control over disadvantages in terms of personal aspects and opportunities that he or she imagines has the opposite effect, and starts with a reasonable loss calculation and learning techniques such as bootstrap and bricolage, Not only can encourage start-ups, but can also increase the likelihood of future restarts by inducing inherent motivation in the event of a failure and reducing actual failure

costs. David Crouch (2017) argues that bricolage "has potential as a result of change." Garud and Karnøe(2003) argue that entrepreneurial behaviors may be experimental, cumulative, regional, and not specific final states, and that entrepreneurs can engage in bricolage and combine resources into new problems and opportunities.

Sarasvathy (2001) argues that Bricolage is based on the process of inventing a venture business and requires additional testing to improve efficiency. Social entrepreneurs, by adopting traditional methods and Bricolage theory explicitly or blindly, And the intention of entrepreneurship on entrepreneurial behavior is to find resources to make new entrepreneurship using previously identified opportunities(Gartner, 1985), Bricolage theory can be used as a resource that entrepreneurs can use to create social entrepreneurs from what they can (Baker & Nelson, 2005, p.349) as they discover and grow social ventures in poor environments (Mair and Mart, 2009; Di Domenico et al., 2010). Chandra (2015) notes that Bricolage is highly relevant to entrepreneurial growth and not only enhances loyalty to the network it also affects corporate growth and can influence the development of entrepreneurial capabilities. Nick Wees (2017) argues that Bricolage is "a collective action involving multiple actors through the practice of individual actors and creative strategies." The following hypothesis was derived through this study.

Hypothesis 3. Bricolage will have a positive impact on Occupational choice.

Methods

Definition of variables and measurement of variables

The variables and measurement tools used in this study were composed of questionnaires through the review and interpretation of experts according to the results of domestic and foreign studies. All variables except 'demographic' (7), which is a likert score of 7 for 'not at all' and 'very good', respectively.

Entrepreneurship was measured by using 8 items according to the situation of this study. In Bricolage, the items used in the study of Senyard et al. (2013) were modified according to the situation of this study. And 8 items were measured. The occupational choice was reconfigured for the items used in the study of Linan & Chen (2009), and the 9 items were used to measure the attitude toward entrepreneurship and the employment attitude used in the study of Hooft & Jong (2009). Table 1 shows the measurement items and related studies used in this study.

<Table 1> Measurement Items

variable	question	Metrics	Number of questions	Precedent research
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Entrepreneurship	A1	Degree of new challenge	8 questions	Yoon(2012)
Bricolage	B1	Degree of utilization of personal resources	9 questions	Senyard et al.(2013)
직업선택	C1	Intention to occupational choice	9 questions	Linan & Chen(2009), Hooft & Jong(2009)

Data and analysis methods

The purpose of this study was to investigate the students who attended entrepreneurship education classes from November 13, 2018 to November 22, 2018. 92 questionnaires were used for the final questionnaire and 92 questions were used for the analysis. The questionnaire was designed on the basis of previous studies, and was analyzed using SPSS 21.0 and AMOS 21.

Result

<Table 2> General characteristics of the sample

	Category	Frequency	%
Gender	Man	70	76.1
	Woman	22	23.9
	Total	92	100
Grade	First students	0	0
	Second grade	7	7.6
	Third grade	39	42.4
	Fourth grade	46	50.0
	Total	92	100.0
Specialized Major	Architectural Engineering	6	6.5
	Mechanical Engineering	4	4.3

	Multimedia Engineering	3	3.3
	Industrial Systems Engineering	5	5.4
	Advanced Materials Engineering	3	3.3
	Electronic and Electrical Engineering	5	5.4
	Information and Communication Engineering	7	7.7
	Computer Engineering	59	64.1
	Total	92	100.0
Start-up experience	Yes	12	13.0
	No	80	87.0
	Total	92	100.0
SME & Venture Experience	Yes	12	13.0
	No	80	87.0
	Total	92	100
Parents are entrepreneurs	No	39	42.4
	No	53	57.6
	Total	92	100
Acquaintance are entrepreneurs	Yes	60	65.2
	No	32	34.8
	Total	92	100
Future career	Public institutions / public corporations	11	12.0
	Official	2	2.2
	major company	36	39.1
	Small business	1	1.1
	A midsize company	14	15.2
	SME	2	2.2

	Start-up	26	28.3
	Total	92	100.0

Table 2 shows the characteristics of the general sample of the participating college students. There were 70 males (76.1%) and 52 females (23.9%) in the sex. By grade, 46 students (50.0%) in the fourth grade, 39 students (42.4%) in the third grade, and 7 students (7.6%) in the second grade. In detail, there were 59 students (64.15%) in computer engineering, 7 students (7.7%) in information and communication engineering, 6 students in architecture engineering (6.5%), 5 students in industrial system engineering and 7.8% 4 (4.3%), multimedia engineering and new material engineering (3.3%). There were 80 students (87.0%), 12 students (13.0%), and 50 students (87.0%) had no experience in working for SMEs and venture companies. There were 53 (57.6%) and 39 (42.4%) parents, and 60 (65.2%) were not found to have an acquaintance. In the case of future career paths for students, 36 major company (39.1%), 26 startups (28.3%), 14 A midsize company (15.2%), 11 Public institutions / public corporations (12.0%), Government employees, SMEs 2 each (2.2%), entrepreneurship education shows that students choose various occupations by occupational choice for large corporations and public officials.

Reliability and Validity analysis

The factor loadings were over 0.5 and the Cronbach's Alpha value was 0.6 or more. The factor loadings were 0.5 or more and the Cronbach's Alpha value was 0.6 or more. The results are shown in Table 3. Since the KMO value is greater than .5, there is no problem in the fit of the factor analysis and the p-value is less than 0.05 in the Bartlett value. Cronbach's Alpha value is also 0.6 or more, indicating that there is no problem in reliability verification (No, 2015).

<Table 3> Reliability and Validity Results

	Component			Cronbach's Alpha
	1	2	3	
occupational choice 4	.907			0.929
occupational choice 2	.889			
occupational choice 3	.877			
occupational choice 5	.850			
occupational choice 6	.743			
occupational choice 1	.668			
Bricolage7		.784		
Bricolage6		.742		
Bricolage4		.728		

Bricolage8		.728		
Bricolage5		.711		
entrepreneurship 5			.799	
entrepreneurship 2			.714	0.823
entrepreneurship 1			.711	
entrepreneurship 4			.688	
entrepreneurship 3			.594	
Rotation squared loading (accumulate %)	27.909	49.520	67.162	
Kaiser-Meyer-Olkin sample fitness				0.875
Bartlett's unit matrix test	Approximate chi square			928.888
	df			120
	Significant level			0.000

Correlation analysis

Table 4 shows the results of the correlation analysis. Entrepreneurship is explained by Bricolage (59.7%), entrepreneurship and career choices are explained by 43.6%, statistically significant correlations are low, and bricolage and job choice by 45.7% are statistically significant .

<Table 4> Correlation analysis Results

		entrepreneurship	Bricolage	occupational choice
entrepreneurship	Pearson correlation	1	.597**	.436**
	Significant level(both sides)		.000	.000
	N	92	92	92
Bricolage	Pearson correlation	.597**	1	.457**
	Significant level(both sides)	.000		.000
	N	92	92	92
occupational choice	Pearson correlation	.436**	.457**	1
	Significant level(both sides)	.000	.000	

	N	92	92	92
**. The correlation is significant at 0.01 level (both sides).				

Hypothesis Verification

Regression analysis was conducted to verify the hypotheses of this study. As shown in Table 5, the independent variables were selected as entrepreneurship and Bricolage was selected as the parameter dependent variable as the occupational choice. In Model 1, the regression model is suitable because the regression model of entrepreneurship and occupational choice is 0.000, which is smaller than $p < 0.05$, and the modified R-squared value indicating the explanatory power of the regression equation is 19%. The regression model is suitable because the regression model of Entrepreneurship and Bricolage, occupation choice of Model 2 is 0.029, 0.009, which is smaller than $p < 0.05$. The modified R-squared value showing the explanatory power of the regression equation is 25.1% and Durbin-watson is 1.712, which is close to 2, so it can be considered as independent, and since VIF is smaller than 10, it can be considered that there is no problem of multi-collinearity.

<Table 5> Regression Analysis Results

model		Nonstandard coefficient		Standard coefficient	t	Significant level	Collinearity statistics		Durbin-Watson	R ²
		B	Standard error	beta			Tolerance	VIF		
1	(a constant)	.816	.772		1.057	.293			1.712	.190
	entrepreneurship	.650	.141	.436	4.601	.000	1.000	1.000		
2	(a constant)	-.136	.828		-.164	.870			1.712	.251
	entrepreneurship	.378	.170	.254	2.220	.029	.644	1.554		

Bricolage	.485	.181	.306	2.672	.009	.644	1.544
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The path analysis is used to verify the research hypotheses represented by the paths based on the research model. The regression analysis is repeatedly applied to confirm the causal relationship between a number of endogenous variables and exogenous variables. This study uses AMOS 21,0 Table 6 shows the results of path analysis. The fitness of the model should be more than 0.9. The lower the CMIN value, the better the GFI should be 0.9, the CFI 0.9, and the AGFI 0.9. However, AGFI has a low dimension.

<Table 6> Path Analysis Results

Model	CMIN	GFI	CFI	AGFI
Default model	0.000	1.000	1.000	
Saturated model	0.000	1.000	1.000	
Independence model	66.338	0.665	0.000	0.330

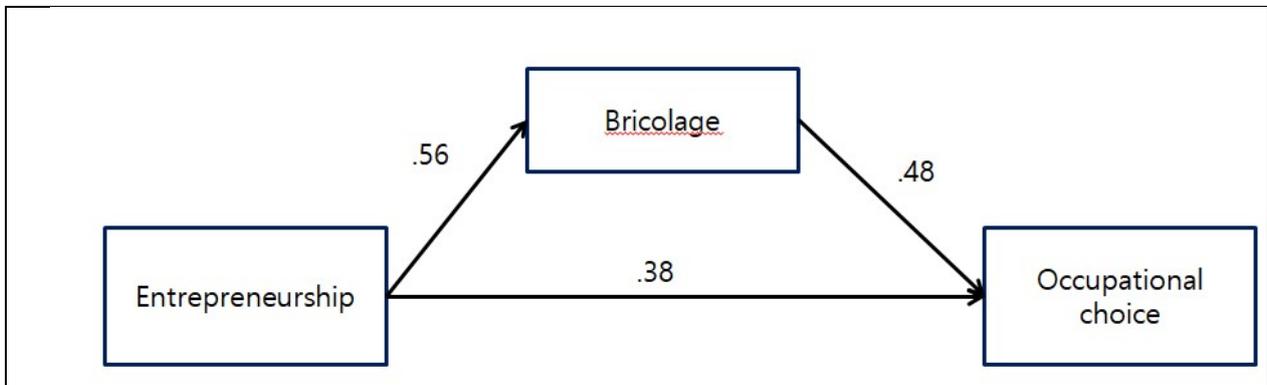
The results of the hypothesis test of the model are shown in <Table 7>. Entrepreneurship and Bricolage were 0.000, which was smaller than $p < 0.001$. Hypothesis 1 was adopted as a positive influence. Hypothesis 2 was adopted as a positive effect because Bricolage and occupational choice were 0.000 and less than $p < 0.001$. Entrepreneurship and occupational choice were 0.025, which was smaller than $p < 0.05$, so Hypothesis 3 was adopted.

<Table 7> Hypothesis Test Results

			Estimate	S.E.	C.R.	P	Results
Bricolage	←	entrepreneurship	.560	.079	7.098	***	Adoption
occupational choice	←	Bricolage	.485	.179	2.702	0.007	Adoption
occupational choice	←	entrepreneurship	.378	.168	2.245	0.025	Adoption

The results of the path analysis of the research model are shown in <Figure 2>. The advantage of

path analysis is that it can simultaneously estimate multiple interdependencies, make it easy to decompose effects, and know whether the model fits well with the data. Entrepreneurship accounts for 38% of career choices, entrepreneurship and Bricolage account for 56%, and Bricolage and occupational choice account for 48%.



<Figure 2> Research Model Results

Conclusion

This study examined the effects of entrepreneurship, bricolage, and occupational choice on the effects of entrepreneurship on occupational choice for university students. Empirical results show that entrepreneurship has a significant impact on Bricolage and entrepreneurship has an effect on occupational choice. In addition, Bricolage has a significant effect on occupational choice, and Bricolage has mediating effects on entrepreneurship and occupational choice. Based on the results of this study, it can be seen that entrepreneurship can enhance the ability to choose from various occupational groups in career choice. This is similar to the work of The KAUFFMAN Foundation and the University of Arizona (Albert & Gray, 1985-1998). Bricolage has the same meaning as Tiphaine Liu (2016). In addition, Bricolage is able to find career paths in the future with diverse perspectives on entrepreneurship and occupational choice. Therefore, entrepreneurship can lead to higher Bricolage.

Based on the results of this study, the following implications are Implications.

First, it is applied to Bricolage as a factor influencing by applying the research model through occupational choice from the viewpoint of entrepreneurship in order to examine the difference between the two. Previous studies have explored the effects of entrepreneurship on occupational choice, but applied the new variable Bricolage as another variable. Second, studies using Bricolage as a variable are extremely rare in Korea. When the term Bricolage is translated into Korean, it should have its true meaning and it is expected that it will help students in career decision making if entrepreneurship and Bricolage are diversified in the future. Third, entrepreneurship and Bricolage will develop as an education to develop adaptive ability to overcome hardship and adversity by demonstrating individual ability by utilizing their own opportunities and resources, rather than

creating an inventor.

Although the results and implications of this study are limited, they can present future research directions.

First, it is necessary to demonstrate the influence of Bricolage in other departments and nationwide because there are limitations on the generalization of the results of the study. First, it is necessary to demonstrate the influence of Bricolage in other departments and nationwide because there are limitations on the generalization of the results of the study. Second, there is a shortage of Bricolage previous research and it is difficult to draw a hypothesis. In subsequent studies, using Bricolage leading variables, there will be more valuable research results if various research methods including not only college students but also ordinary people are applied.

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27.

How Do Relational and Organizational Characteristics Affect Joint Knowledge Creation in the Period of the Post-Merger Integration?

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Abstract

This study examines how relational and organizational characteristics affect the joint knowledge creation during the post-acquisition period. We investigate the effect of geographical proximity, technological dissimilarity and change of organizational identity on joint knowledge creation using the data from 136 high-technology M&As during 2000–2004. Our empirical results show that geographical proximity and technological dissimilarity creates less joint knowledge by collaborating with engineers from both organizations. We also find that change of organizational identity is negatively related to joint knowledge creation.

Purpose/ Research Question:

What determines the success of Mergers & Acquisitions (M&As)? While much of prior research is about post-acquisition integration, the locus of academic attention had mostly been on a structural integration (Shin et al., 2018). Only a few studies were interested in joint knowledge creation through interpersonal collaboration between engineers of the target and the acquirer from the viewpoint of knowledge integration.

This study aims to fill in the gaps mentioned above, thus explored new methodologies of joint knowledge creation from human interactions between the acquirer and the target. We investigated joint knowledge created through communication and social interaction between engineers who carry tacit knowledge using joint-patent filing.

Key Literature Reviews (About 3~5 papers)

- Geographic Proximity and Joint Knowledge Creation

Both geographical proximity and organizational similarity increase interaction among engineers for the acquiring firms and targets. It leads to create more joint knowledge. Even if organizational similarity exists between the two organizations, it would be difficult to make face-to-face interactions that are required for tacit knowledge transfer (Yun et al., 2016). However, it is expected that there would be an active human interaction and communication with the local community in the post-acquisition period, if there exists a geographical proximity between the acquirer and the target. Regardless of an organizational similarity, it is expected that a geographical proximity will have a strong influence on the joint knowledge creation. Therefore, we predict the following:

Hypothesis 1. Higher geographical proximity between the acquirer and target will lead to the increased joint knowledge creation after the M&A.

- Technological Similarity and Joint Knowledge Creation

When two companies are technologically similar, it could mean that the two companies share similar knowledge base at the firm level, but it doesn't necessarily mean that the individual engineers have similar knowledge at the individual level (Son et al., 2018). It is especially likely that knowledge that

is distinct due to the tacit is not easily accumulated using documents but rather embedded as knowledge in individuals. If two companies are technologically similar at the firm level, the technological domains or products between focal companies are similar. Although individuals have a different tacit knowledge, there will be facilitated communication and human interaction in the same product area.

Hypothesis 2. The more technologically similar the acquirer and target's knowledge is, the more joint knowledge creation, there will be after the M&A.

- Change of Organizational Identity and Joint Knowledge Creation

Many companies have gone through the integration process to increase synergy effects after M&As. This integration eventually leads to change of organizational identity. When members of the target are forced to accept their new organizational identity without any change in self-concepts, these members are likely to treat their previous organizational identity as ideal and neglect to accept any similarities between the two organizational identities. This tends to make it harder for members of the target to accept the organizational identity of the acquirer (Empson, 2004; Witt, 2016).

Hypothesis 3. A rapid change of organizational identity after the M&As will lead to the decreased joint knowledge creation.

Design/ Methodology/ Approach

We collected 1,744 M&As that had taken place in the U.S. from 2000 to 2004 and filtered sample which had both the acquirer and target to file a patent within five years prior to the M&A, arriving at 136 M&As. Secondly, we examined 42,098 patents filed by the target and acquirer for 5 years prior to the M&As and extracted a list of 40,695 engineers involved. Lastly, we inspect 45,478 invented patents filed either by the acquirer or the target in the post-acquisition period to identify joint knowledge creation. We have analyzed those hypotheses from the perspectives, which are relational and organizational characteristics. We also obtained some significant and interesting results.

Zero-Inflated Negative Binomial (ZINB) model adds an additional mass at the zero value of joint knowledge creation resulting in a higher proportion of zeros that is not consistent with the underlying Negative Binomial (NB) model. We employed the ZINB regression model.

(Expected) Findings/Results

This study investigates relational and organizational antecedents which affect the joint knowledge creation between the acquirer and the target in the post-acquisition period. We have identified various factors using prior research on organizational knowledge management (e.g., Argote et al., 2003), exploring different organizational, relational and post-M&As characteristics. In this study, we find some interesting results exploring different relational and organizational characteristics in high-technology M&As.

Research limitations/ Implications:

First of all, there is a potential sample selection bias in our sample, because we basically could not include engineers who did not file a patent before M&As. Inventors who continued patenting after M&As may have been systematically different from those who were not productive prior to M&As. Due to the inherent data limitation, we could not include those inventors who have done joint-patent filing only after M&As. However, it has been identified that over 70% of all post-M&As patents were filed by engineers that were included in our list of engineers.

Keywords

Joint Knowledge Creation, M&As, Relational Characteristic, Organizational Characteristic

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A Study on the Factors Influencing Public Technology-based Start-ups

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29.

Business model with sharing economy under the smart city

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Abstract

Business model must be adaptive over times in response to changing the markets, technologies, environmental, and economic circumstance. For companies, being increasingly scarce in resources business model is becoming business constraints. Under the circular economy the principles of a new approach to business modelling is necessary. Limited exploitation of the resource in earth planet forces firms to change their business model. The aim of this paper is to suggest pertinent business model in circular economy. To fulfill it, a qualitative methodology is used. This paper suggests five business models: green-loop model, pass-loop model, having-loop model, being-loop model, and hybrid-loop model. In the beginning phase, while it takes a long time for them to become mainstream, it is conceivable that firms be adopted step by step to a minority of existing business. In the long run, this new approach can give rise to the evolution of new business model. Business model in circular economy contain the principles of maximizing energy use efficiency by minimizing the total energy consumption of producing products or services. Cost and convenience

for both firms and consumers are the key critical factors to be channeled in the new business model for innovation to achieve the greening and efficiency objectives.

Keywords: business model; green economy; circular economy; circular business model; innovation;

1. JEL Classification Codes:

1. Introduction

This paper aims to provide pertinent highlights on the business model designed in circular economy (CE). Namely, this paper seeks to a new conceptual framework for business models from a research question perspective; which business models do emerge in circular economy area? Business models evolve over times (Teece, 2010; Chesbrough, 2002; Zott, et al., 2011). The advent of circular economy might be caused by the concept of sharing economy and environmental and sustainability technologies. Also, relationship between industry and environment is important for business performance. Since planet earth's resources are limited, ceaseless exponentially economic growth cannot be met without serious consequences for health and environment (Meadows, et al., 1972). Currently, environmental impacts have gradually increased pressure on especially industry business sectors. Circular economy involves three main circle of concerns, i.e. environment, resources, and economic benefits (Lieder and Rashid, 2016). In the evolving circular economy, both firms and customer should strive to keep resources in use for as long as possible, extracting the maximum value from them while in use, then recover and regenerate products and materials at the end of each service life. This include the 3R principles of circular economy, namely reduce, reuse and recycle of material (Heshmati, 2015).

In most developed and developing countries, attention has been paid to the issues of sustainable development and growth. In doing so, what is required is a new approach in which each country aims at a new type of development. Resource conservation and enhancement that links to the provision for all an adequate livelihood base and equitable access to resource is required for circular economy. When it comes to environment, it has been linked one to another. Suppose one country pursues the energy policy that has a goal to diminish air pollution, by which as a result air condition of a country could be improved, but economic growth rate might be lower than before without a new business model. In the same context, if a country strengthens agricultural development, this policy may be associated with worsened environment due to enlarge the root of land, water, and forest degradation. For the reasons listed above, this paper seeks a new business model for circular economy. It is intended to embrace the circular economy.

Just a few decade age, many developed countries, begin to realize that we must find an alternative development strategy to replace our current behavior which affect burdening future generations resulting from our misplaced belief that there is a choice between economy and environment. In this paper, the concept of circular economy (CE), sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Circular business models may obtain a greater competitive edge in the years to come because they create more value from each unit of resource than the traditional linear production and consumption model. It is needless to say that innovation is related to the firm growth. Innovation, environment and economics are closely inter-related.

However, most innovation studies pay little attention to the innovation and environment relationships. Circular economy is an industrial ecology that is restorative or regenerative by intention and design. These days, a range of factors (i.e., population growth, resource scarcity, climate change) impacts and an array of regulations addressing issues from toxic substances to zero-waste initiatives—are placing pressure on companies to move away from an industrialized open economy make-use-dispose linear economic model to a more circular strategy.

It replaces the end-of-life concept with restoration, renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere. The aim is elimination of waste through the superior design of materials, products, systems and business models. In order to implement these objectives, this paper explores the current CE research landscape and then analyzes the acquired information. In the next step, the outcome is evaluated with reference to the comprehensive CE scope, i.e. resource scarcity, environmental impact and economic benefits.

Finally, the business model for innovation is proposed as a way forward towards implementing the comprehensive CE approach in the industry sector. This paper offers five business models: green-loop model, pass-loop model, having-loop model, being-loop model, and hybrid-loop model.

This paper is organized in five sections where Section 2 presents the research methodology in detail and state of current research on CE. Once the circular economy notion is clarified, in the Section 3 researches on business model innovation are discussed. Section 4 presents business model typology in circular economy. Finally, in Section 5, conclusions are drawn from the performed research.

2. Literature Review and Research Methodology

2.1 Methodology

This paper is a conceptual discussion based on literature analysis (Creswell, 2007; Patton, 2002). Qualitative research offers flexibility in applications which are more sensitive to the complexities of social phenomena like business activities than quantitative methods, which offer clearer, directly observable indicators (Creswell, 2007). In this research, in order to identify the current academic insight regarding the circular economy concept, published articles including general journals and academic books and reports were utilized. In particular, Scopus, Google, Web of Science including many books, magazines, and periodical journals were mainly used. Document type “article”, “editorial” and “review” are mainly used.

After classifying abstracts, articles irrelevant to the research topic were scanned. Since major share of the articles are focused on china, this research tries to account for a comprehensive overview of the literature. As a result of the review of fourth six fields has been narrowed down, namely ‘industrial ecology dealing with patterns of material and energy flows within and outside of industrial systems, including technological dynamics’ ‘Environmental science containing studies of

environmental impacts through e.g. industrial systems including their consequences on natural environmental through waste and emission', 'business and economics containing studies on economic concepts and analyses to the problems of formulating rational managerial decisions'.

2.2 Circular Economy

Environment and business circumstance are closely inter-related. However, most business studies pay little attention to the environment. Environmental degradation is not only a national problem but a global one. The challenge of the 21st century is facilitating and strengthening democratic cooperation on sustainability at the international level to promote the environment, human health and wellbeing. Since 2001 the European Council has been urging members to formulate their national sustainable development strategies so that in cooperation with the UN system this can lead to worldwide development of a sustainable development strategy.

The word 'circular' means closed loop instead of open loop system. When taking that production resources (e.g. natural resources, human resources, capital) are important factors in economy into consideration, we can understand that circular economy is closed loop economic system based on limited resources. Rapid environmental deterioration around the world has led to the development of policies for reducing the negative impacts of production and consumption on the environment. A number of countries have introduced acts and laws for establishing the recycling principle of a circular economy.

The concept of CE combines several previous concepts, and therefore it has a wide scope. In this section, a definition of a circular economy is given based on several studies and overviews are provided from all sub concepts and aspects through prior scholar's perspectives. The concept of circular economy was first emerged in 1980s by Stahel and Reday-Mulvery (see the work of Stahel and Reday-Mulvery, 1981). Discarded resources such as water and nutrient in earth planet could become resources for others. The concept of circular economy birthed out of the idea of substitution of labor for energy since energy prices and unemployment are being risen in the middle of 1970s. At those days, as an architect, they felt that it took more labor and fewer resource to refurbish buildings than to erect new ones (Stahel and Reday-Mulvery, 1981).

In this view, economic success should not be measured by only industrial production, but rather, by nature and earth's resource stock including humans. Stahel's priority concerns has been the extension of products in order to minimize energy and material flows (Stahel, 1982). Environmental, resources and economy have closely related to manufacturing products and services. In this context, the study on circular economy can be classified into three areas: resource oriented, economic oriented, and environmental oriented definitions.

Firstly, a study of what a circular economy is based on resource-oriented perspective is needed for looped system because of resource scarcity. Heshmati (2015) asserts that circular economy with its

3R principles (reducing, reusing, and recycling material) has strong linkage with resources. The first use of the term “circular economy” was found at a book, *Economics of Natural Resources and the Environment* by written by Pearce and Turner (1990). In their work, the authors illustrate that ignoring the environment means ignoring the economy as this is a linear or open-ended loop system without an in-built system for recycling of wasted material.

Some researchers have emphasized use of the material balance model. In other words, resource supply, waste assimilation and utility have been identified as a function of the economy of resources use as well. The circular economy represents a development strategy that maximizes resource use efficiency and minimizes waste production (Hislop and Hill, 2011). This concept emphasizes the benefits of reusing and recycling residual waste materials. It includes energy, water, different byproducts as well as knowledge (Jacobsen, 2006; Park et al., 2010; Yuan et al., 2006).

According to Preston (2012), a circular economy is an approach that would transform the function of resources in the economy. He also has emphasized that waste from factories would become a precious input factors to another process. Beside, products could be repaired, reused, or upgraded instead of being disposed.

In line with resources, to diminish the waste and resource scarcity is the homework for social entrepreneurship (Pauli, 2010). In this context, new business models which will be discussed in the section below are promoted with the underlying motivation of environmental problems with scientific solutions based on natural physical process. Circular economy is an alternative way of reducing the large gap in resource requirements and supply shortages in relation to the population and industry structure (Vermander, 2008). The boom in economic growth and surge in the output of heavy and energy intensive industries have implied a doubling of energy consumption over the last decade (Guan et al., 2012). Energy is mainly sourced from non-renewable polluting sources. Heshmati (2014a) suggests use of demand response to reduce the consumption of electricity.

Utilization of gravity is an example. Shifting from an economy that is based on scarcity to an economy that is based on resource abundance solution may depend on innovators. According to Ellen MacArthur Foundation (2013), a circular economy goes beyond the pursuit of waste prevention and waste reduction to inspire technological, organizational, and social innovation throughout the value chain in order to ‘design-out’ waste from the beginning, rather than relying solely on waste recycling at the end of the chain. Ellen MacArthur Foundation (2015) expresses material flow aspect of resources.

Secondly, reviewing the circular economy as both economic aspect and environment aspect has provided an opportunity to understand with regards to derived business model for a circular economy (BMCEs). Originally, economic system is part of the large system that is planet earth.

The economic and environmental system are interdependent, and studies of the joint economy-environment system in the light of principles from the natural science, thermodynamics, should be a priority.

In the practical level, if human beings can be able to live without environmental degradation, available renewable resources may be an answer. Generally, since one of the economic goals is value creation, linkage among each actor (i.e. supply, demand, customers, manufacturers) is a critical perspective. According to Van et al. (2015), circular economy is an economy that is an economic and industrial system based on the reuse of products and raw materials, and the restorative capacity of renewable natural resources. It attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system.

For, European Commission (EC, 2014), defines the concept as “a development strategy that enables economic growth while optimizing consumption of resources, deeply transforms production chains and consumption patterns, and redesigns industrial systems at the system level.” Instead of the depletion of resources, in a circular economy waste is ‘design out’ and consumed materials are to be used as nutrient in the linked usage cycle. Ironically resource shortages are triggering the creation of new business models (Ellen MacArthur Foundation, 2013; Bakker et al., 2014).

Most importantly, the effluents of one process would serve as the raw material for another process. The industrial ecosystem is consequently expected to function as an analogue of biological ecosystems. Industrial ecology encompasses a systemic, comprehensive, integrated view of all the components of the industrial economy with relatedness to biosphere. Industrial ecology is a research area of material and energy flows. Circular economy encompasses industrial ecosystem. Waste and byproducts should be met for ecology: (1) eco-industrial network, namely waste become resource of others, (2) new production and services could be designed to minimize dispersion or at least eliminate its harmful effects, (3) the objective is to minimize total matter (and energy) flows, and (4) fossil fuels is the source of many environmental problems (Erkman, 1997).

When considering prior literatures, circular economy can be defined as a system related to resource, environment and economy that seeks to optimize the total material cycle from original materials to finalized material, to component, to product, to obsolete product, and ultimate disposal. Based on literature review, one can derive the comprehensive circular economy framework as illustrated in Figure 1.

Insert Figure 1 about here

Circular economy is a reservoir holding critical topics and a system, considering the fact that essential activities for successful implementation, such as business model is the agent. Ultimate goal of circular economy is thus to maximize the added value from products, and is to completely eliminate waste.

3. Business Model in a Circular Economy

Users or manufacturers constantly make decisions about how to spend and raise capital. These decisions are influenced by numerous factors in volatile world. Circular economy is currently seen as a necessary concept which emphasizes fundamental changes in today's dominating business models (Stahel, 2010).

For the circular economy to be embraced, enterprises need to address existing challenges and redefinition of business model. Generating market demand through incentives focused on cost and convenience will help to bring the circular economy to market and scale. According to released survey results (GreenBiz Group, 2016), the biggest barriers to implementing an effective global circular economy shows that insufficient business opportunity is the highest response (38%), and that logistics cost to reclaim used goods is second (36%), and lack of consumer understanding and education (36%). The third rank is other business objective taking priority (30%). When considering survey results, numerous enterprises take diminishing business models as the biggest risk.

It is required to know what a business model is. Business models must morph over times as changing markets, technologies and legal structures (Chesbrough, 2007; Teece, 2010). As technologies and market conditions are changed over times, business model, new and better way to satisfy both customers and firm is needed. As the advent of internet, scholars (Zott and Amitt, 2010; Zott et al., 2011; Amitt and Zott, 2012) have paid attention to business models. Even though, no generally accepted definition of 'business model' has yet emerged, each corporate has its own business model. When it comes to business model, some scholars have devoted a growing amount of attention to business model innovation (Chesbrough, 2002; Teece, 2010; Zott and Amitt, 2010; Zott et al., 2011; Najmaei, 2013). Business model can play a role to conversion of value delivered to the customer into value captured by the enterprise (Čirjevskis, 2016). Business model was analyzed in evolution perspective, Han and Cho (2015) suggested PSM (Preparation, Spread, Evolution) curve, composed of three phases: the preparation phase that establishes the platform to set the target group; the spread phases where killer content is provided in the early stages of the platform, such as KakaoGame, a low pricing strategy, and reinforcement of the platform rules; and the evolution phase where the platform continues to evolve.

A business model is the way how a business creates and delivers value to customer (Teece, 2010). In short, a business model could be defined as the manner in which an enterprise creates and delivers value to customers, and then converts the payments that are received into profit (Björkdahl, 2009; Chesbrough, 2007; Zott and Amitt, 2007; 2010; Zott et al., 2011). Business models are defined in terms of a firm's economic model (Morris et al., 2005). The business model concerns the logic of how profit is generated by the firm. Steward and Zhao (2000) assert that the business model is a statement of how a firm will both make money and sustain its profit stream over time. Furthermore, the business model can be defined as an architectural configuration of the firm's survival. Slywotsky (1996) noted that a business model consists of the totality of how a company selects its customers, defines and differentiates its offerings, defines the task it will perform itself and those it will

outsource, configures its resources, goes to market, creates utility for customers, and captures profits.

A business model is related to a number of other managerial concepts, and it captures the key components of a business plan. The business model components consist of price, product, distribution, organizational characteristics, and market strategy (Horowitz, 1996; Timmers, 1998; Dubosson-Torbay et al., 2001; Hamel, 2001). Business model must be evaluated against the current state of the business ecosystem, and against how it might evolve (Teece, 2015). No matter the industry sectors where a firm belongs to, there are criteria that enable one to determine whether or not one has designed a good business model.

Business models yield value propositions that are compelling to customers, achieve advantages in terms of the cost risk structures, and enable significant value to be captured by the business (Han and Cho, 2015). Prior studies are referenced in this study to define the business model of a company as a simplified representation of its business logic. The business model is defined in the ways of how a firm survives in terms of delivering and capturing values. Recently business model research area is the sustainability economy. Bolton and Hannon (2016) suggested that a systems based approach to the analysis of business models as embedded in their socio-technical contexts can offer new insights into the dynamics and governance of sustainability transitions. Business model can flow the value, sharing profits between two strategic partners, manufacturer and retailer to maximize an individual profits as well as total profits concurrently in reverse supply chain (Yoon and Jeong, 2016).

As was reviewed above, current model of business models can gain benefit in terms of growth and profit from encouraging over-consumption and waste which generate significant negative environmental and social externalities. However, under circular economy worlds, new business models which can reduce consumption and waste are necessary, and they will bring fruitful gains to firms and users. According to explanation by Semple (2014) and Wicki (2013), business models are systems of interrelated component. So that, if one component changes, others often have to change. For example, creating a new value may require new processes and resources.

As a circular economy made appearance, prior studies dealt with different definitions of business models. To implement circular economy firms often require a new business model (BM). Closing resource (material) loops change different goods or services, different customers, different production process and different profit methods. They can include other types of value than financial profit.

Stahel and Reday-Mulvey (1981) note that business model can enhance the product life through reuse, re-manufacturing, and maintenance. They emphasize on changes from ownership to stewardship; consumers become users and creators on highlighting remanufacturing and repair of old goods creates skilled jobs. Stahel and Reday-Mulvey also advocated product life extension in terms of reuse, re-manufacturing and maintenance. And Stahel (2016) emphasizes recycling on a

material level in circular economy from selling product to selling services. This model could become an ultimate business models to close the loop. Namely, they assert that in circular economy circumstance recycling, reusing materials on a molecular level become an importance business model.

University of Cambridge, Institute for Leadership (2016) states that broadening the level of engagement of business through multi-stakeholder partnerships can help business gain, build more efficient supply chains and reduce costs by sharing the implementation of solutions with others. Also they suggest the overview on business models as: (1) product as a service, (2) design manufacture and distribution, (3) usage, (4), reuse and redistribute, and (5) refurbish, remanufacture and product recycling. Mentink's work (2014) has given a productive concept to understand what business model for a circular economy (BMC) is.

Insert Figure 2 about here

Business model for a circular economy (BMC) should be regards as a subcategory of business models which fit in an economic system of restorative or closed material loops (Mentik, 2014). And he explained that BMCE is not close material loop by itself rather, BMCE is a part of business models which together close a material loop in order to be called circular. From Figure 1, blue material cycle can be regarded as BMCE. BMCEs keep materials, and enable other firms to do so. And business model 1, 2, 3 and 4 in Figure 1, together close the blue material loop. Business model 6 and 7 are regarded as non-circular. Business model 5 cannot be regarded as BMCE because if a firm makes goods out of recycled material, but in such a way that it is too difficult to recycle the materials again, the firm impede a closed material loop.

Mentik (2014) suggests that a circular business model is the rationale of how an organization creates, delivers and captures value with and within closed material loops. Namely, BMCE can be conceptualized by: (1) maintenance, (2) repair, (3) redistribution (reuse without treatment), (4) upgrading, (5) remanufacturing, (6) recycling, (7) energy recovery, and (8) Disposal. Lacy and Rutqvist (2015) and Lacy (2014) proposed 5 business models for circular economy. First, it is the circular supply chain model. This is fully renewable, recyclable or biodegradable material that can be used in consecutive lifecycles to reduce costs and increase predictability when firms need resources that are scarce or environmentally destructive.

For instance, an enterprise produces renewable and eco-friendly biomass resources by using flax, hemp and other fibers that leads clothing companies produce a garment without cotton's cultivation. This model can diminish environmental risk. Second, it is the recovery and recycling model. This creates productions and consumptions by utilizing everything that used to be considered waste.

And this is revived for other uses. Third, it is the product life – extension model. Even users discard

products when they are no longer value. But many of them still hold useful value, and the product life-extension model seeks to recapture it. Firms can keep economically recapture value as long as possible by improving products through upgrading, repairs or remaking. This business model gives a firm to keep value from merely selling products to keeping them alive and relevant.

Fourth, it is the sharing platform models. Sharing means sharing things when they are not used by using internet and other digital technologies. The sharing platform model can connect the products for those who want to use them. For instance, things that were stored in a home, but they are infrequently used. Those products can be shared through a platform. Fewer resources go into making products that are infrequently used, and customers can have a new way to both make and make money. In fact, this business model can be frequently seen because new entrepreneurs start an own business through this business model like Airbnb (home sharing), Uber and Lyft (car sharing, ride sharing).

Fifth, it is the product as a service model. This model can be called as a lease model. When manufacturers or retailers should spend lots of cost and times to keep them. In order words, when total cost ownership is high without using they could immediately try to come up with cost down ways.

So they would adjust their focus on to longevity, reliability and reusability. Customers can benefit from leasing or pay for product by use in terms of the product as service model. Firms have an opportunity to create new relationships with customers. Bakker and Hollander (2014) suggested some BMCE models such as the classic long-life model, the hybrid model (combine durable product with short-lived consumable), the gap exploiter model (components of products that last longer than the rest), the access model (customer pays for access to product) and performance model (customer pays for performance instead of product). In case, the classic long-life model, it focuses on delivering long product life, and supporting design for durability and repair.

In order to make product long lived, firm should take care of design for repair, refurbishment and remanufacturing. In the hybrid model, it focuses on durable products that have short life cycles. Namely hybrid model is a combination of a durable product and a short lived consumable. Products was manufactured by taken disposable materials into consideration. In this way the obsolescence is planned. Gap exploiter model is a model that gives values. This model is focused on exploiting the residual value of products. In an ideal case, firms themselves refurbish or remanufacture.

In the access and performance model, firms provide the capability or services to satisfy customer needs without needing to won physical products. In perspective of circular economy, the manufacturers or service providers retains ownership regarding items, products and is therefore incentivized to make the product last as long as possible. Mouazan (2016) described importance of customer relationship (collaboration) to transit from liner model to BMCEs. Generally, business model is firm-driven in the linear model. However, circular business models are associated with relationships at value network level.

One of the important barriers to the transition towards BMCEs is related to the final consumers. To overcome the barriers, Mouazan (2016) suggested sectoral level approach with specific “customer segments” targeted to uncover how personal, cultural, social and psychological factors should be understood to create successful circular marketing strategies. Collaboration can help a company in changing and re-designing its business model (Demil and Lecocq, 2010; Troy et al., 2008). By reviewing literature on the business model for a circular economy, certain widely agreed structure factors constituting BMCEs can be derived.

Author suggests the key principles of business model for a circular economy (BMCEs) as follows. (1) the circular business models should have eco-friendly principles based on the re-use of products and resources, and the restorative capacity of natural resources. (2) It can operate to minimize waste in product process and system design by utilizing adequate materials (e. g. fewer composite material); design for facilitating recycling; strive for easy solutions. (3) It can operate to maximize value proposition through design. This should create not only intrinsic value but also added value by applying product design for easy or repair of product life cycles; and strive toward recycling usage. (4) It can minimize and reduce energy use through technology innovation aiming at maximizing energy efficiency to produce products and services. (5) Manufacturers and customers should understand “total ecosystem” of a business and ensure this is reflected in the business model for keeping circular closed loops. (6) It can collaborate to operate business model. In general collaborative relations increase the level of cohesion within groups and between their members (Luukkonen and Nedeva, 2010). And collaboration between manufacturers and customers requires exchange of information (Troy et al., 2008) and coordination of activities across interdependent.

4. Business Model Typology in Circular Economy

As mentioned above, our current economy’s feature (i.e. production, consumption) patterns a linear (take-make-use-dispose) approach to resources use. The transition from current linear ways of doing business to the circular economy approach will not be easy. Fully 100% linear business model and 100% circular business model do not exist since there are several limitations such as leakage of energy in the implementation level. In spite of it, from the findings, in contrast to today’s linear model (‘take-make-use-dispose’), a circular economy offers a development strategy that enables economic growth by capturing value in using resources efficiently through circular business models. In fact, circular economy aiming to create added value in products for as long as possible and eliminate waste. The transition from a linear process to a circular process requires change in the use of materials and also a change in structures of ownership, business models and responsibilities. BMCEs offer instruments for translating products designed for re-use into attractive value propositions.

This perspective requires manufacturers to think differently about products and to take responsibility

for products during the life cycle. Following questions are needed to be asked in order to find how the used products can be made valuable again: (1) what business models are appropriate for a specific product? (2) Can the product be offered as a service rather than be sold as a product? (3) Which optimization options are available for restorative (reuse, recycle, re-manufacturing, reduce) for production-chains? (4) How can value flows (social, natural and/or economic) be translated to allow for better charting of the benefits of the circular economy? And last but not necessarily least, (5) How can design to be manufactured and distributed?

Table 1. Circular economy business model typology.

Circular economy business models	Feature (characteristics)	Strategy	Value creation
Green-loop model	Product is focused on material sourcing (circular supplies), product-transformation and resource recovery.	Minimization of materials Eco-friendly resources utilization	Value creation by using eco-friendly resource recovery and upcycling Cost effective and reduction by using alternative materials instead of scarce resources in earth planet Cost savings by using recycling and re-manufacturing
Pass-loop model	Product as a service supply. Products can be used by many customers,	Developments of sharing platforms in the collaborative consumption and de-materialization	Value creation for each new use/change of user Sharing of underused resources.
Having-loop model	Product ownership remains in customer and repair, reuse.	Maximization of product life extension Upgraded to extend its lifetime	Value creation for maintenance, Repair, Reuse, Redistribution, Refurbishment, Remanufacturing, upgrading, Recycling, Energy recovery and at the

			last resort, disposal.
Being-loop model	Products go back to the manufacturers. Resource is reused for same or different product,	Maximization of products life extension	Value creation in resource recovery
Hybrid-loop model	Product is using materials that can be reused for another use eco-friendly customer's participation	Extend material use Minimize resources, energy Focus on resource sourcing, resource recoverability and resource efficiency	Value creation in resource recovery and multiplication of product from same resources Value creation in remaining at the end of one product lifecycle to feed into another

The circular economy is a strategy to secure natural resources for our industry, and as such is, therefore, considered a long-term necessity to achieve sustainability.

Insert Figure 3 here about

From the circular economy business model typology, five business models was suggested. Circular business model innovation can be summarized as follows:

1. Circular business model of innovation should be focused on product life extension. Value could be maintained in terms of remanufacturing (e.g. designing for endurance) repair, upgrade, or remarketing
2. Circular business model of innovation should be focused on resource efficiency and resource recovery
3. Circular business model of innovation should be focused on product as services (e.g. sharing platform and renting)

But, the notion of circular economy business model refers to a conceptual approach. To entice

payment from customers by offering values, the business logic is required to go to customers. Firms' behaviors are needed (e. g. to select technologies and features to be embedded in the product, to determine benefit to the customer from consuming, to confirm available revenue stream, to identify market segments, to design mechanisms to capture value). Business model choices is the same as business architecture choices. Shafer et al (2005) described a business model as firm's implementing core logic and strategic choices for creating new value within a value network. For firms preparing the upcoming future, strategic choice can determine their destiny.

5. Conclusion

In our current linear economy, approximately 80% of what we use is being thrown away after usage (Sempels and Hoffmann, 2013). The goal of this study is to find a business model of innovation in the circular economy. To fulfill the goal, we search for numerous case studies including literature reviews. A circular economy is an alternative to a traditional linear economy (take, make, use, dispose) in which resources are kept in use for as long as possible, value creation is maximized in the use phase and products and materials are recovered at the end of each service life.

In this paper, five business models are focused on: (1) green-loop model, (2) pass-loop model, (3) having-loop model, (4) being-loop model, and (5) hybrid-loop model. All models suggested have common principles (i.e. economic benefit, resource scarcity, environmental impact), but each model has own characteristics respectively.

Initially business model for a circular economy (BMCE) innovation was driven by mainly start-ups. In order to keeping a change for firms and customers, they should seek new business models and innovation under the circular economy. Most importantly, they choose the business model that is right for their business even though no one know right things for a firm to succeed in the upcoming circular economy. In adjusting or exploitation the new business models, firms make sure to have a business ecosystem including external enablers.

New business models, no matter what kinds of business model is chosen should contain that waste is eliminated or minimized, and monetized. And they should serve customers, and drive business and product development over time. Finally, new business model should be designed following and operating circular economy business principles creating a circular flow from making to production, taking-back, and profitable regeneration and reuse in the closed material loop.

In spite of findings, this paper has some limitations. It is acknowledged that contribution to empirical level is limited because this paper mainly deal with theoretical approach. A large portion of companies per circular business model should have been used to validate assumptions but also to draw specific feature per circular business model. In the same context, this paper is only related to the qualitative approach used in the methodology. To elaborate weakness of this paper, quantitative data could be used for explain the each business model success both profitable perspective and

earth's environmental aspect.

In a future study, the author can implement it through the data from firms using the business model for a circular economy (BMCE).

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Figure 1. Conceptualization of Circular economy

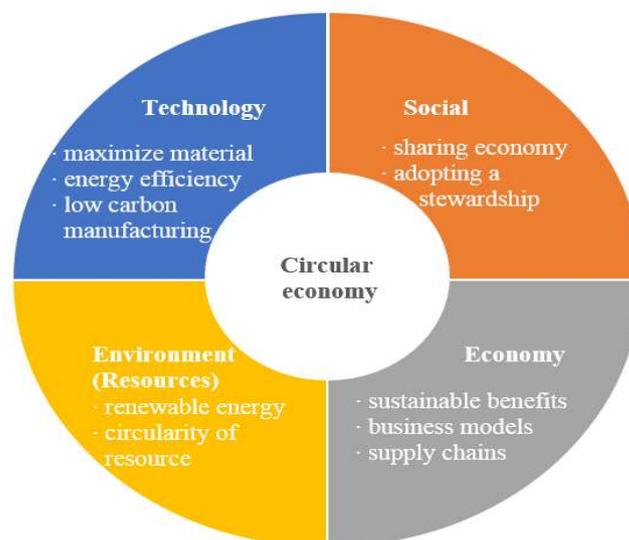


Figure 2. Circular, semi- and non-circular business models (source, Mentik, 2014)

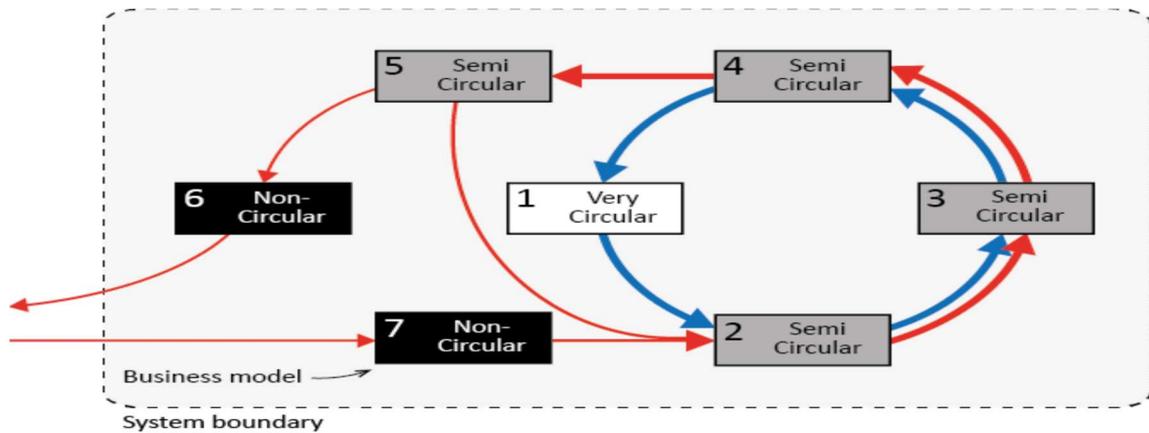
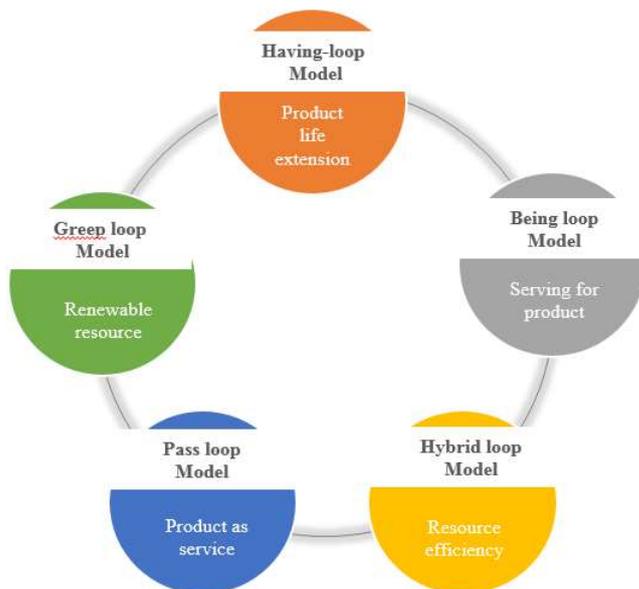


Figure 3. Circular economy business model



30.

Study on preventive measures against exposure to risk factors, causing industrial disasters

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Abstract

Research Institute has been conducting surveys of work place environment at each 3-year interval with a total of 5 surveys completed including the 5th survey in 2017 since the 1st survey in 2006. Accordingly, this study aimed at attempting in-depth analysis of the results of work place

environment surveys for each of the 4 research themes in order to find hazardous factor information for preventive measures against exposure to risk factors causing industrial disasters.

Summary of the outcomes of analysis for each of the 4 research themes is as follows:

First, in the analysis of the effects of exposure to risk factors on the level of health for each occupation, the influential factors on the mental disorders of administrative and professional occupations were found to be ergonomic factors, such as postures inducing pain and repetitive movements, etc., rather than risk factors for mental state of workers. In addition, risk factors such as depression and anxiety were found to be relatively higher for those involved in sales and skilled occupations in farming, forestry and fisheries rather than those who are in administrative and professional occupations.

Second, in the analysis of the effects of perception of safety for each of the employment types of workers on injuries and damages, damages arising from accidents were differed according to job security. Non-permanent workers, they perceived more serious adverse effects on health than permanent works did. Moreover, males displayed greater injuries than females. In particular, damages were found to be greater in non-permanent workers if they have lower level of academic background.

Third, in the analysis of the effects of risk factors for according to shift-work system causing absence at the work place it was found that risk factors of the day time workers are characterized in terms of dynamic work more that static work, and discrimination due to status at workplace. Interestingly, for the evening workers, numerous risks factors that can be able to occur during the daytime disappear because works are exposure to physical dangerous factor unlike daytime. So, likelihood of risks caused by verbal offensive atmosphere relatively is low. while the night workers are exposed relatively more extensively to the risk factors of static works, and to socio-psychological risk factors arising from discrimination due to status at workplace and verbal violence.

Fourth, in the analysis of the effects of ergonomic risk factors on the musculoskeletal disorders, it was found that risks factors from the perspectives of age, gender and ergonomics impart significant effects on the musculoskeletal disorders in all the occupations according to the level of exposure to risk factor such as those in service sectors as well as those with low level of exposure to risk factors such as administrators, etc.

The Classification Analysis of Social Entrepreneur and Its Related Factors: Using Latent Class Analysis Method

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Purpose/ Research Question

- This study would pay attention to social entrepreneur who operate the social enterprise. Previous studies on social entrepreneur have mainly examined how social entrepreneurship affects the performance of social enterprise(S.E). In addition, strategy, environment, networking factors are being treated as influence factor of performance of S.E.
- Research on social entrepreneurs needs to consider not only social entrepreneurship but also entrepreneurial qualities. So, this study defines social entrepreneurship and social entrepreneur's qualification as main characteristics of social entrepreneur and is going to classify characteristics of social entrepreneur and to its related factors
- The research question of this study is as follows; First, How are social entrepreneurs classified in terms of their entrepreneurship and qualities? Second, What are the factors related to the classification of social entrepreneurs? We will analyze environment, networking, and performance as related factors.

Key Literature Reviews

- The Factors affecting the performance of social enterprises

Research on the success factors of social enterprises reveals that human factors, organizational factors, environmental factors affect performance. Human factors include CEO's managerial capacity, leadership(Shin, 2018;Kim & Jung, 2015), employee competence(Wadee & Padayachee, 2017;Quiroz-Niño & Murga-Menoyo, 2017), and innovation capability of manager(Yusr, 2016), social entrepreneurship (Weerawarden & Sullivan, 2007). Organizational factors include governance, organizational structure, and management strategies. Environmental factors include networks with various stakeholders(Kim & Lim, 2017;Gupta et al, 2017), social networks(Park et al, 2018;Du & Guo, 2015) and competitiveness.

- The Relationship between Social networking and Performance of S.E

Networking is one of the most important features of entrepreneurship research. Through networks and partnerships, companies reduce uncertainty, promote exchange of skills and know-how, and strengthen their dynamic capacity to respond to environmental changes. According to previous

studies, networking has a positive correlation with performance and growth of firms.

- The Relationship between Social Entrepreneurship and Performance of S.E

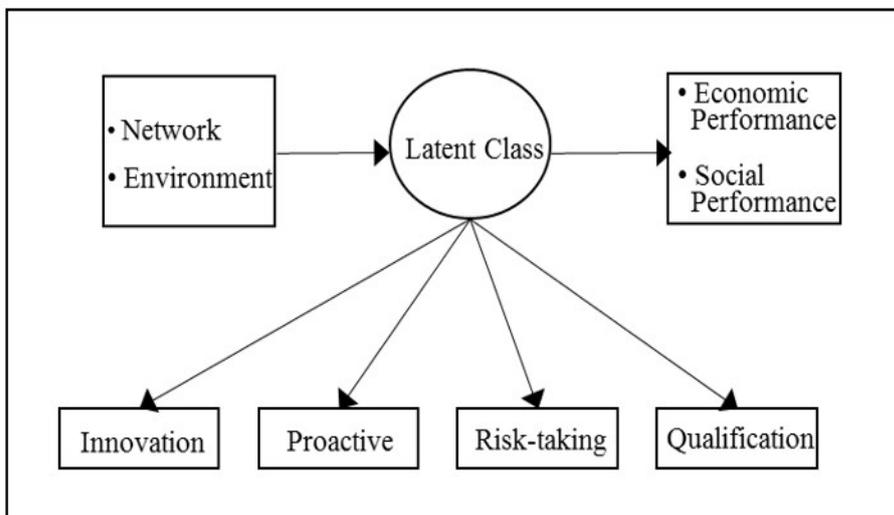
Social entrepreneurship is defined as behavioral characteristics. Weerawarden & Sullivan(2007) proposed innovativeness, proactiveness, risk management as a component of social entrepreneurship. This definition is focusing on the operation process of social enterprises and behavioral characteristics of entrepreneurs are presented as core concepts of social entrepreneurship.

Bornstein(2007) presented 6 qualifications that a successful social entrepreneur should possess. Self-correction will, Commitment to share achievements, Willingness to change existing framework, Willingness to cross the realm, A willingness to work quietly, Strong morality.

Design/ Methodology/ Approach:

- Latent Class Analysis (LCA) was used to identify performance of social enterprises underlying social entrepreneurship and entrefication profiles and explore relationships between latent class memberships and related factors expected to have relationships with respondents' latent class membership.
- We first built an LCA model for social entrepreneur's attitude based on response pattern of respondents. A series of LCA models with different number of latent classes were compared using likelihood-based information criteria (IC) (e.g. AIC and BIC) and entropy values and then the best-fitting model was selected for the final interpretation of the results.

research model

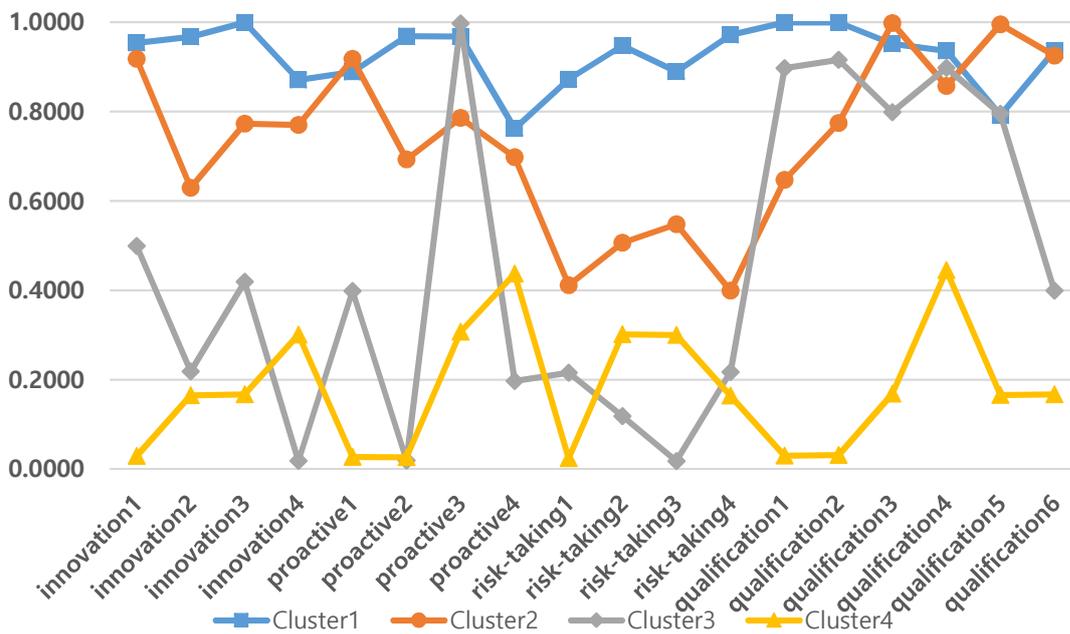


- After identifying the best-fitting model, the effects of external variables (e.g., covariates and distal outcomes) were then estimated using multinomial logistic regression models. The network and environment were used as covariates, which predict latent class memberships, and economic performance and social performance of social enterprises were selected as distal

outcomes that are predicted by latent class memberships.

(Expected) Findings/Results

- According to the fit measures, the best-fitting model was the four class model. The results revealed that Class 1 consisted of approximately 66.4% of the respondents whose overall conditional probabilities were relatively high. Class 2 was characterized by relatively lower conditional response probabilities on risk-taking, compared to other domains. This class includes 15.2% of the respondents. Class 3 including 10.7% of the respondents exhibited higher conditional response probabilities on mindset than other domains. The 7.7% respondents who belong to Class 4 displayed low conditional probabilities across all four domains.



- For the effect of covariate, respondents who showed highest level of network score (16–19) were likely to belong to Class 1, while ones with the lowest level of network score (1–7) had high chance of being in Class 4. The respondents with network score (8-10) displayed high probability of belonging to Class 2, and respondents those who have slightly higher network score (13–15) were mostly classified into Class 3.
- The results of distal outcome (economic and social performance) revealed that that respondents in class 1 was likely to show the best performance among four latent classes, while the performance of respondents grouped into Class 2 tended to be slightly lower than class 1. Among the four classes, the respondents in class 4 showed worse economic and social performance compared to other classes.

Type	Variable	Scores	Class1	Class2	Class3	Class4	Wald
Covariate	Network	1 – 8	0.10	0.31	0.19	0.76	14.72**
		9 – 10	0.24	0.33	0.31	0.18	
		11 – 13	0.14	0.13	0.14	0.04	
		14 – 16	0.31	0.17	0.25	0.03	
		17 – 21	0.21	0.06	0.12	0.00	
Distal Outcome	Social Performance		35.12	32.50	32.03	22.72	18.31**
	Economic Performance		27.08	24.21	22.52	14.29	52.23**

Research limitations/ Implications

- Entrepreneurship and qualification of social entrepreneur is classified into 4 type. Networking is associated with social entrepreneurship and social entrepreneur’s qualifications, and attitude of social entrepreneur is also associated with social and economic performance.
- In order to activate social enterprises, it is necessary to consider the qualitative aspects of social entrepreneur. It also shows that entrepreneurial qualities are important as well as entrepreneurship(Byun et al, 2018).
- Limitation: This study is based on questionnaire responses to social entrepreneurs. So there is limitations of being based on the social entrepreneurs' subjective perceptions.

Keywords: social networking, social entrepreneurship, social entrepreneur’s qualifications, social performance, economic performance.

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32.

Bridging the Gap in the Commercialization Process of Digital Innovative Technology : Focusing on 3 Stage Technology-Product-Market Model

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Purpose/ Research Question

The Budget of the Republic of Korea earmarked for R&D amounts is 19.4 trillion won(16 billion). (2016)

Technology Development is 96% , But, Technology Commercialization is only 47.2% (KERI, 2015)
Commercialization is the process which firm create economic value by converting knowledge, discoveries, and inventions into new or significantly improved products and services that satisfy consumers' needs.

The success of the technology commercialization means that the developed technologies create the economic gain (Kim Chan-ho et al., 2013). But, The critical problem of technology commercialization is that developed technology does not create economic performance.

Markham (2004) illustrates this relation as the 'valley of death', the gap between the technical development of an innovation and the commercializing process. Jolly(1997) describes this as four types of gap in the technology commercialization process.

Why does 'the Gap(valley of death)' appears in the commercialization process?

This is due to developer-oriented R&D are mismatched with market needs.

Technology-oriented R&D is focused on technology innovativeness or newness. If technology developers develop advanced technology, they will evaluate it as outstanding technology by evaluating only on the performance improvement itself. Which could be not on marketability.

But consumers do not always want new or innovative technologies. New or innovative technology requires a lot of changes in existing behaviors and habits. According to the Theory of Technology Resistance, most consumers have a resistance to innovation because they do not have a priori desire for change. And the greater the degree of change, the greater the degree of resistance(Ram, 1987; Ram and sheth, 1989; Sheth, 1981).

As such, understanding asymmetry between developers and customers is a key factor in creating a gap(Jolly, 1997; Son et al., 2015).

Sometimes developers try to evaluate the marketability of technology. However, evaluating and predicting in the developer's perspective is not appropriate because it leads to self-reporting bias and memory and retrospection bias(Chandy and Tellis, 1998; Sorescu and Spanjol, 2008).

Prior research about TAM(Technology Acceptance Model) verify the relationship between acceptance and technology and technology products on the same construct. However, technology is an intangible asset and technology itself does not release in market. The value of the technology depends on the value of the product and is determined by the final product.

Therefore, this study proposes a new model, applied in technology commercialization process, that can verify the market potential of new technology in the consumer perspective.

We develop a "3 stage Technology- Product-Market" model which can measure the value of each stage of technology commercialization by surveying market end-user and testing with a structure equation model(SEM).

It has separate constructs between technology and product.

Research Question 1. What are the key variable that constitute the Technology Innovativeness from the consumer's point of view?

Research Question 2. Does innovative technology have a direct impact on acceptance? Does it mediate the valuation of the product during the productization stage?

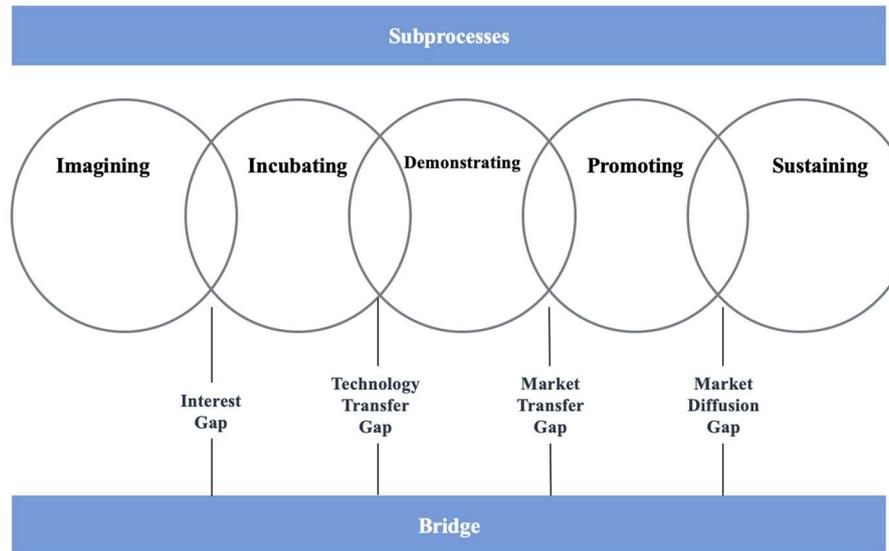
Key Literature Reviews

The Gap in Technology commercialization process (Jolly, 1997)

During technology commercialization process, there are 4 types of gap. Since they are not creating enough value in a predecessor stage to make a technology worth taking further.

In general, the greater the value demonstrated in one stage of the commercialization process, the easier it is to build a bridge to the next one. And in most technology-based innovations, four bridges need to be built to close the circle of commercialization.

Unfortunately, because intermediate values are mainly based on expectations, they tend to be subjective.



The key to bridging is not the developer's subjective judgment about the value of technology and products. It is the validation from the perspective of the consumer and each step needs to be verified for core values.

1. Technology Stage : Perceived Technology Innovativeness

Innovativeness is often related to (i) key innovation characteristics (i.e., relative advantage, compatibility, complexity, trialability and observability), (ii) adoption risk, and (iii) the degree of change from established behavior patterns (Danneels and Kleinschmidt, 2001).

Perceived innovativeness is a formative construct comprising a combination of (i) an overall measure determining how new the product is perceived to be, and (ii) the extent to which the innovation would change consumption patterns (Olshavsky and Spreng, 1996).

Consumer Perception of Innovativeness (CPI) is the perceived degree of newness and improvement over existing alternatives (Lowe and Alpert, 2015).

Sun (2016) has investigated four dimensions of mindful technology adoption. Technological novelty seeking describes concisely comparing a technology with existing technologies to identify the uniqueness-or, rather, the novelty-of the technology, enabling the creation of new categories relating the technology to existing technologies (Verhoeven et al, 2018).

2. Product stage : Perceived Product Value

Perceived value is an overall assessment of the superiority and efficiency of product, which is the motivation for deciding consumer's behavior. It also affects the judgment, preference, and choice of the product.

Recently, consumers are affected by the initial emotional response when they encounter new technologies or products in the field of ICT(Lin and bhattacharjee, 2010; Zhang, 2013). Perceived usefulness cannot explain the adoption of hedonic goods, which do not offer productive utility(Turel et al, 2010) Tangible and highly functional products also provide emotional value(Yoo et al, 2017). In the adoption of information systems with excellent technological advances, the enjoyment of experiencing the newest technology is an important adoption factor, along with the functional benefits(Hong and Tam, 2006).

In particular, products with a high degree of novelty create a hedonistic attitude(Lowe and Alpert, 2004).

3. Market Stage : Purchase Intention

Purchase intention refers to the probability that beliefs and attitudes are transferred to action.
 = Technology acceptance

Design/ Methodology/ Approach

- **Survey**

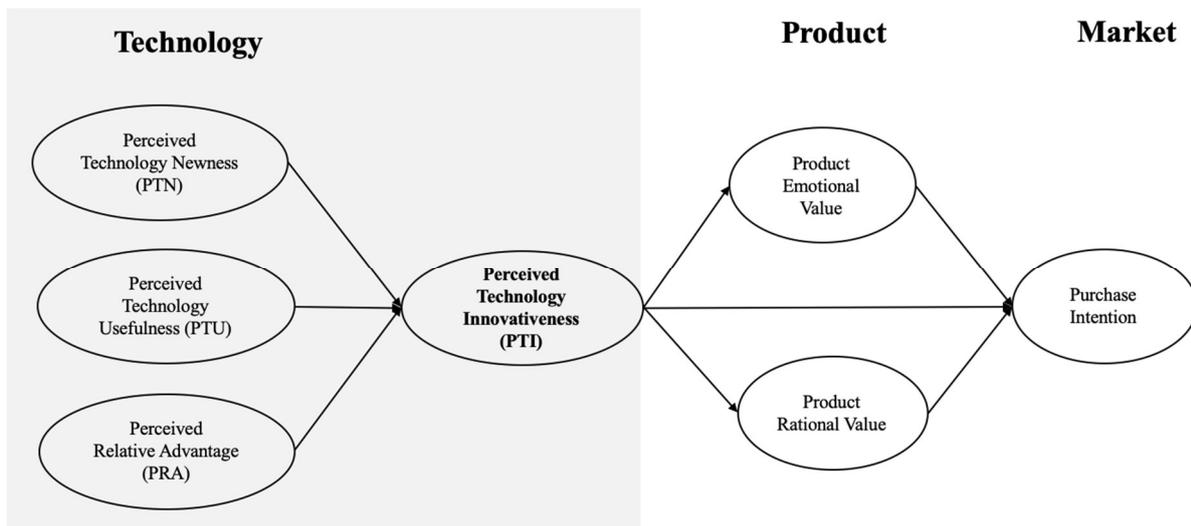
Subjects : Product End-user 350 (USB user)

Object

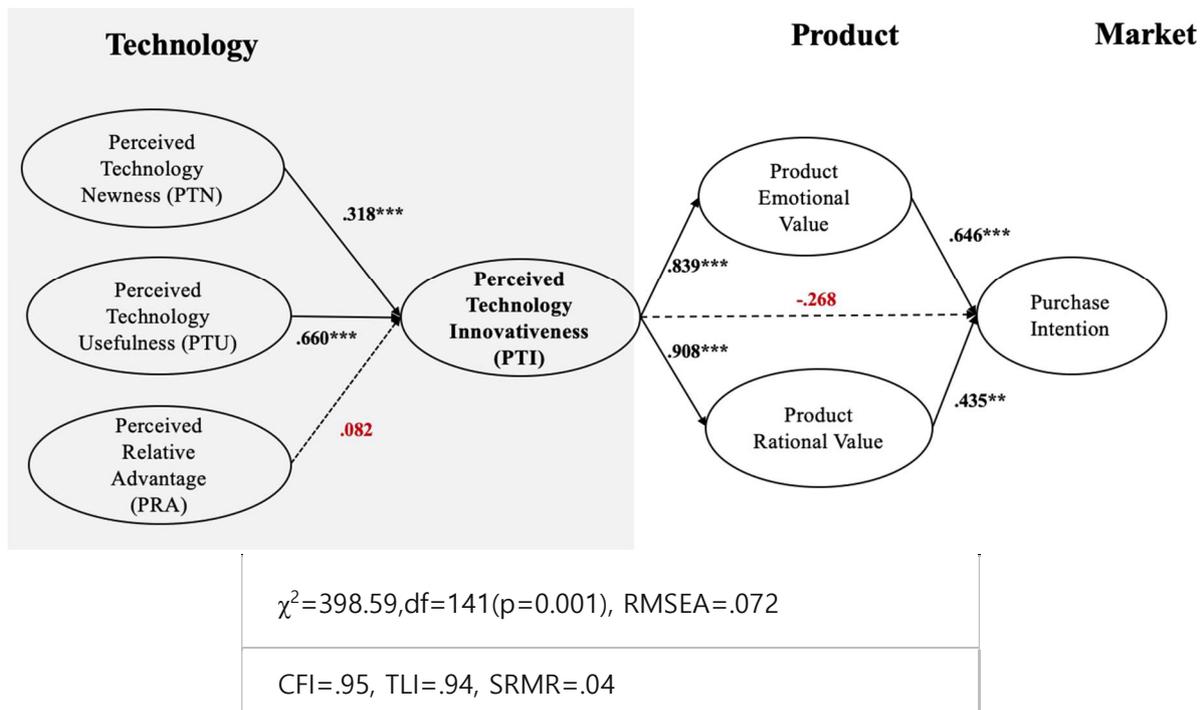
Technology : Zing (High Speed Close Proximity Communications 10 cm World, Developed by ETRI(Electronics & Telecommunications Research Institute))

Product : Wireless USB

- **Research Model :** 3 Stage Technology-Product-Market Model (SEM)



(Expected) Findings/Results



- The key variable of Perceived Technology Innovativeness(PTI) is Perceived Technology Newness(PTN) and Perceived Technology Usefulness (PTU) at the perspective of consumers, not Perceived Relative Advantage(PRA).
- The results of the analysis of the 3 stage TPM model using the structural equation model(SEM) confirmed a mediating effect at the product stage as postulated in the current study.
- It was found that the perception of consumers in the market on technological innovation did not necessarily lead to their intent to purchase; it only did when recognition on the product value was mediated at the product stage by hierarchical χ^2 model.
- In particular, emotional value was found to affect an intent to purchase more significantly than rational value, supporting the findings of previous studies that emotional response is important for early acceptance of innovative technology.

Research limitations/ Implications

- We developed a model that can identify the acceptance of technology for potential customers in the market, which can be used as a methodology for predicting the success of new technology commercialization in the future.
- This model could help understanding the gap between developer's and consumer's perspective to reduce the prediction errors and market failures that have been experienced because technology has been evaluated from a technology developer's perspective.
- It demonstrates the limitations of commercialization strategies that focus only on superiority of technology and also shows the importance of product development strategy. Therefore, it is possible to fully understand the important of product value,

not technology superiority on the stage of new product development.

- However, to standardize this model, we need to test it to various range of technologies and product lines.

Keywords: Technology commercialization, 3stage TPM model, Bridging the gap

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33.

A Study on Profile and Investment Decision-making Factors of Informal Investors for Start-up Investment

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Abstract

Purpose/ Research Question:

This study analyzes the characteristics of unofficial investors in the founding period, secondly, the factors of investment decision making. Third, the empirical analysis of the expected payback period and the recovery method of the investor 's start - up period. This study investigates whether there is a mediating effect on the investment intention of the founder.

The purpose of the research is detailed as follows. First, we examine characteristics of informal investors such as gender, age, educational background, occupation, size of assets, investment scale intended for investment, and experience in investing in entrepreneurship or self-employment. Second, we analyze the characteristics of informal investors who have invested in entrepreneurship and the characteristics of informal investors who have invested in entrepreneurship. Third, we analyze the differences in investment decision factors of informal investors who have invested in

entrepreneurship. Fourth, analyze the differences in investment decision factors of informal investors who have invested in self - employed entrepreneurship. Fifth, we examine whether the characteristics of entrepreneurship, government support factors, and financial characteristics directly affect investment profitability.

Sixth, we examine whether the characteristics of investment entrepreneurship, government support factors, and financial characteristics have a direct impact on the possibility of cashing.

Seventh, we examine whether the possibility of cashing in the investment of founding period affects the investment intention of informal investors, and whether investment incentive for business start-up affects investment intentions to start up self-employment.

Eighth, we examine whether the investment profitability of the investment period on the investment period affects the investment intention of the informal investors, and the investment intention to the entrepreneurial establishment and the investment intention to the self-employment start-up respectively.

Ninth, analyze the mediating effect of investment profitability and possibility of cashing on the investment intention of business start - up and self - employment start - up.

Key Literature Reviews (About 3~5 papers):

The startup, which is a common noun to start a small business newly founded, has been recently one of main targets for policymakers due to its important role for job creation and considerable potential for sustainability of an economy. However, improvement-driven opportunity entrepreneurs decreased by 5.0% from 2013 to 2016 in Korea. For increasing start-ups and start-up investment, Policies have been mainly focusing on venture companies at grow stage or 2~3 years ahead of IPO through venture capital firms and angel funds. The investment on these venture companies is clearly different stage from start-up investment by informal investors.

Design/ Methodology/ Approach:

The purpose of this study is to investigate the characteristics of informal investors, the factors of investment decisions, the characteristics of investors who have invested in business start - ups and investors who have invested in start - ups of self - We analyze whether the possibility of realization of investment and investment profitability affect the mediation.

In order to be a basic data for the expansion of future research on informal investors, we will survey the aged 18 to 64 years old with reference to the GEM questionnaire. The questionnaire design was the most important, and the questionnaires were revised and supplemented by interviewing the questionnaires' questions to 37 respondents first. Therefore, research model and hypothesis are set up based on research methodology.

(Expected) Findings/Results:

Profile of informal investors for new firms in Korea are male (46.7%), age 50(54.2%), graduated from university(43.9%), USD500,000 ~ 700,000 of property(56.5%), and business management in job(80.0%). Profile of informal investors for self-employed business in Korea are female(43.9%), age 60(52.9%), graduated from high school(51.2%), USD100,000 ~ 300,000 of property(47.6%), and self-employed business in job(78.7%).

This study shows the possibility of investment payback is mediated by the investment intention of self-employed business, and investment profitability is analyzed as mediating effect on investment intention of entrepreneurship. It is analyzed that investment decision-making factors for start-ups between venture firm and self-employed business are different each other. Also, The returns of investment are expected to get business profit within 3 years in case of self-employment start-up, and to sell the stock to the invested firm or unlisted corporation stock market in case of investments on start-up firms within 5~7 years.

In order to motivate and expand the investments by informal investors to the start-up firms, it is required to amend the law so that the start-up firms can likely purchase stocks from investors within 5~7 years as exit method. In the case of investing in self-employment business, it shows that it should be institutionalized so that the rental contract for a shop / office with its owner is not terminated within three years in accordance with the Commercial Leasing Act.

It may have its academic significance as a preemptive research which identifies profile of informal investors investing in the start-up period. It also identifies profile of informal investors investing in a necessity-motivated new business(a self-employed business) is different from the profile of informal investors investing in an opportunity-motivated new business(a firm).

It suggests that various exit methods of the investments for start-up firms, such as unlisted corporation stock market shall be considered to Government policies.

Research limitations/ Implications:

The limitations of the research are the persons who are not the unspecified number of adults but the acquaintances of researchers 'associates and researchers' associates, the founders and executives of small and medium venture firms, and those engaged in financial / , Those who have experience in start-up investment, and self-employed people have a limitation that they do not represent all industries by mainly food business, car center, real estate brokerage business, and one-man business (trade business, consulting, etc.).In addition, because of the lack of prior research on the characteristics of informal investors and investment decision-making factors, we surveyed the investment decision-making factors and removed statistically insignificant factors and statistically analyzed only statistically significant variables. The results of this study are summarized as follows. The future directions of the research are as follows: (1) how much the investment amount of the investment intention increases when the investment return period is institutionalized for three years,

five years and seven years; and (2) (3) Investigate the expected return on each investment period. Based on the in-depth study of the possibility of cashing and the mediating effect of the investment profitability on the activation of the investment in the start-up period, It is necessary to establish a system that can sell and buy and to create a virtuous cycle ecosystem environment to revitalize private investment in the establishment period. Investors who have invested in entrepreneurship, non-experienced people groups, investors in self-employment start-ups Analyze differences in investment decision factors between experienced and unexperienced groups to consider priorities among investment decision makers And the investor 's characteristics. It is necessary to analyze the analytical hierarchy process (AHP) of the investment decision factors so that the informal investor can use the investor.

Keywords:

Informal Investor, Investment Decision-making, Start-up financing, Investment return, Investment intention

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34.

An empirical study on the obstacle factors affecting R&D outsourcing on a basis of Innovation Resistance Model: Focus on the Automotive R&D in Korea

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Abstract

Purpose/ Research Question:

This thesis introduces the "innovation resistance model" with empirical methods in order to explain why R&D outsourcing is not actively pursued in the Korean automotive industry. The study examines how the factors of R&D outsourcing (transaction cost characteristics, innovation characteristics, and user characteristics) recognized by R&D personnel in Korean automotive firms influence their resistance to or acceptance of R&D outsourcing. It also suggests ways to overcome the obstacles to R&D outsourcing in order to expand its presence.

Key Literature Reviews (About 3~5 papers):

R&D outsourcing, as a representative practice of inbound "open innovation," plays a positive role in enhancing technological capability and technological innovation in knowledge intensive industries. However, R&D outsourcing has not been widely recognized as a bridge of technological innovation in Korea, and the Korean automotive industry is no exception.

Design/ Methodology/ Approach:

In this study, the variables influencing the resistance and acceptance intention of R & D outsourcing in the automobile industry are classified into transaction cost, innovation, and user characteristics of R & D outsourcing. The characteristics of innovations in R & D outsourcing include perceived usefulness, suitability, and risk variables. The characteristics of users include the perception of R & D personnel, the tendency toward innovation, Self efficacy variables were considered. In addition, it was constructed so that the resistance of research and development workers influences their acceptance intention.

Results were obtained through basic statistics and multiple regression analysis of 202 questionnaires of R&D personnel from 39 Korean automotive firms. The findings of the study are as follows.

(Expected) Findings/Results:

The findings of the study are as follows. First, R&D personnel believe that "technological competence and credibility" of R&D service providers and their own "managerial competence and efforts" are the key factors influencing R&D outsourcing success. Second, transaction cost advantage, usefulness(innovativeness), and compatibility as perceived by R&D personnel reduce resistance to R&D outsourcing. On the other hand, perceived managerial risk and organizational culture and attitude that are unwilling to adopt change increase their resistance. Third, transaction cost advantage, usefulness(innovativeness), compatibility, and suppliers' competence and credibility perceived by R&D personnel positively influence their intention to accept R&D outsourcing. The most influential factor in their acceptance is the resistance to innovation itself.

Research limitations/ Implications:

In order to revitalize R&D outsourcing in practice, we need to reduce resistance to innovation through the better perception of usefulness(innovativeness) of R&D outsourcing, and create business environments that can strengthen and/or fairly evaluate the competence of R&D service providers. Finally, we need to develop a cooperative approach and institutional policies to minimize the managerial risks and inconveniences that may arise between clients and service providers.

Keywords:

R & D outsourcing, open innovation, research and development workers, innovation resistance

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35.

A Study on the Impact of the Innovation Capabilities of Service Firms on the Performance in the Global market : Focusing on the Interaction Effect of Service R&D

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Abstract

Purpose/ Research Question:

The research on the service industry has been carried out in earnest since the second half of 2000. However, the initial research has been focused on supporting the growth of the manufacturing industry (Howells, 2000, Korea Institute for Industrial Economics and Trade, 2008). Recently, the service industry is regarded as a new strategic industry that will lead the future industry, and various research fields such as service innovation, service R & D, growth factor, productivity. However, there is still a lack of research on the relationship between service company innovation and business growth and development. In the fourth industrial revolution and economic service, it is necessary to study focused on the service companies in the international economy. Furthermore, analyzing service companies' ability to advance into the global market can be used as a basis for finding alternatives to overcome the downturn in global exports facing the Korean economy. Therefore, it is considered that the comparative study on the competence and the performance of the service companies should be proceeded by benchmarking the research of the enterprise capacity in the manufacturing enterprises which has been active for the past 20 years.

The purpose of this study is to investigate the relationship between innovation capability and global performance of service firms in Korea, and to find out that R&D, which has been emphasized as a key factor that attracts growth of manufacturing industry, results of this study are summarized as follows.

Key Literature Reviews (About 3~5 papers):

Innovative activity by service firm has supplier dominated attribute, and service innovation has regarded as facilitators, imitators, and passive reactor of manufacture company innovation (Howells, 2000).

표 1 Innovation: Manufacturing versus Services ‘System Traits’

N o .	System Trait	Manufacturing	Services
1	IPR	Strong; patents	Weak; copyright
2	Technology orientation	Technology ‘push’; science and technology led	Technology ‘pull’; Consumer/client led (co- terminality)
3	Research/innovation	‘In-house’	Mainly sourced externally

	generation and supply		
4	Labour productivity	High impact	Low impact (until 1980s?)
5	Innovation cycle times	Short	Long (except for computer services)
6	Product characteristics	Tangible, easy to store	Intangible, difficult to store
7	International 'servicing'	Exports, then FDI	FDI, then exports
8	Spatial scale of system or 'reach'	National -> Global	Regional-> National -> Global

Innovation of service industry can be defined as the development of new service products or the provision of new services by changing and adding existing services, or a series of innovations related to ideas, new structure (De Jong et al, 2003), and the factors affecting the novelty of markets and processes can be categorized into innovation capabilities of service firms.

Cainelli, Rinaldo and Maria (2006) found that innovation has a positive effect on firm performance in service firms in the UK. Kraus (2011) confirms that entrepreneurship of service companies has a significant effect on firm performance, and 310 entrepreneurs of Austrian service firms have an empirical analysis. Jo (2012) shows that entrepreneurship of service firms affects market orientation, and that market orientation has a positive effect on export performance as a result.

Market orientation makes service innovation possible and has a significant impact on export performance (Jaw, Lo and Lin, 2010).

Therefore, in the globalization of the service industry, relationship marketing with customers is necessary, and through this, it is possible to enlarge the corporate performance by forming, maintaining and developing continuous relationship with customers (Copulsky and Wolf, 1990).

The type of service R&D is divided into four types based on the degree of novelty about customers and services.

First, service improvement type refers to research and development activities to improve the delivery system of existing services or to provide high quality services by combining humanities and social sciences factors. Second, service extension type means R & D activities to provide new customers with existing services based on existing services. Third, customer expansion type is R&D activities to provide more customers with services that are provided to limited customers through improvement of delivery system, cost reduction, and customized commercialization. Fourth, service creation type means R&D activities to create new market by creating new services that have not

been provided by combination or fusion of service, technology, product, culture and knowledge.

Design/ Methodology/ Approach:

The purposes of this study were to investigate the relationship between the innovation capabilities of the service firms and their global performance and to identify the role of service R&D in this relationship.

The empirical analysis has two steps. First, we analyze the relation between the innovation capabilities of service firms and global performance by Multiple Regression Analysis. Next, Hierarchical Regression Analysis was performed to identify the interaction effects between service R&D capabilities and other capabilities. Data for this study were collected from a complementary survey based on 2015 KOTRA(Korea Trade & Investment Promotion Agency) list. The analysis was performed on the total of 243 service firms.

(Expected) Findings/Results:

The effort of service R&D have a positive impact on global performance through the interaction of managerial entrepreneurship and customer orientation

Research limitations/ Implications:

A practical implication of this study is that the government policies for the globalization of Korean service firms should be established and implemented in the framework of Foreign Direct Investment as well as trade because successful survival and growth of Korean service firms in the global market need multidimensional localization strategy based on customer relations, network capabilities and entrepreneurship.

Keywords: *Innovation capability, Service R&D, Global performance, Service firm, Servitization*

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36.

Factors affecting merger and acquisition performance in pharmaceutical industry

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Abstract

Purpose/ Research Question:

The concept of ‘Open innovation’ (hereinafter ‘OI’), is actively leveraged from various kinds of industries including automotive, robotics, aviation [13], and even in architectural area [14,16]. Naturally, many researchers have endeavored to offer a persuasive framework and their efforts are ranging from general conceptual models [18] to industry-specific-models [17]. Thanks to the previous achievements, nowadays OI is considered as one of the most popular and indispensable survival strategies of biopharmaceutical firms as well, due to its inherent properties – high value, high uncertainty – of biopharmaceutical industry [10-12]. Given this high-risk environment, M&A has been leveraged from both small and medium-sized enterprises (hereinafter ‘SME’s), and large enterprises. SMEs use M&A not only as a survival strategy but as an exit strategy, which would enable them to maintain their momentum toward a new product development, whereas large enterprises use M&A as a way of finding new drug candidates. Therefore, there has been consistent efforts and studies to reveal factors that affect the outcome of mergers and acquisitions. These efforts and studies have struggled to explain the outcome and the influencing factors, in various ways – in terms of acquirer’s experience, size, the strategic fit of acquirer and acquiree, and more – but only few have consolidated the factors, especially in the biopharmaceutical industry. Thus, this is the point where our question starts: what are pre-M&A factors that affect the outcome (performance) of M&A deal and can the relationship between the factors and the outcome be empirically proved?

Key Literature Reviews (About 3~5 papers):

Among studies to reveal contributing factors of open innovation performance [15], King *et al.* [1], have analyzed 93 published studies through meta-analytic review, categorizing commonly used factors into 4 different groups: conglomerate firms, related acquisitions, method of payment, acquisition experience.

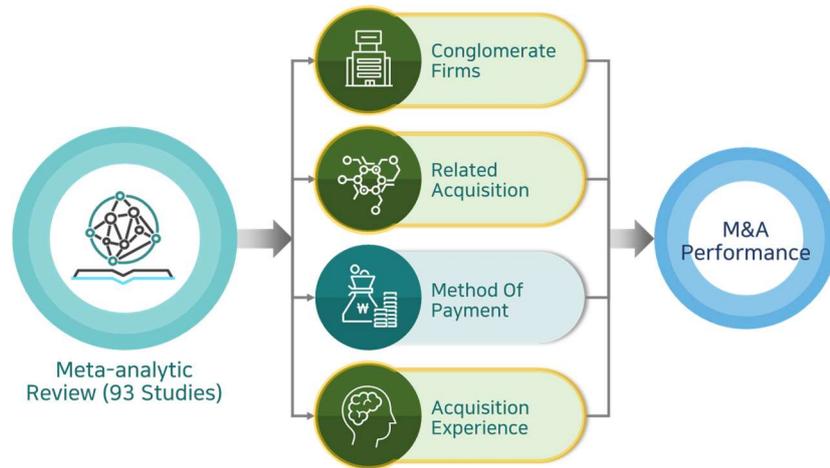


Figure 1. King's framework for affecting factors of M&A performance

The 'conglomerate firms' factor investigates acquirer's organizational and business structure of a firm, whether the acquiring firm consists of two or more completely different area of business, whereas related acquisitions, also defined as business relatedness or industry familiarity, investigates to which extent the area of business of both the acquirer and acquired firm is similar. The method of payment mentioned is two-fold: to pay with cash or to pay with stock shares (equity). Regarding the acquisition experience, the experience can be broadly divided into two different sectors: individual experience and organizational experience.

In a similar vein to King et al.'s approach, through a systematic investigation of state-of-the-art studies in leading journals, Gomes *et al.* [2] have organized the critical success factors into 6 distinct groups: 'choice and evaluation of the strategic partner', 'pay the right price', 'size mismatches and organization', 'overall strategy and accumulated experience on M&A', 'courtship', 'communication before the merger', and 'future compensation policy'.



Figure 2. Gomes' framework for affecting factors of M&A performance

Firstly, ‘Choice of partner’ argues that the degree of ‘strategic fit’ and ‘organizational fit’ is one of the most important measures to determine successful M&A. Also, excessive payment of M&A deals are frequently known as the cause of the failure of a deal, therefore ‘pay the right price’ highlights the size of the premium paid for M&A deals or method of payment (cash/stock). For ‘size mismatches and organization’, on the other hand, it has been believed that the relative size of the two companies participating in M&A will affect the performance of the deal. If the size of the acquirer is too small or too large, the possibility of the amount of interest paid in mergers and acquisitions can be small or too large rises, which will eventually end up in apathy or to a political fight. ‘Overall strategy and accumulated experience on M&A’ claims that M&A experience is a critical factor, and ‘courtship’ can be understood in a similar manner. The factor, ‘courtship’ argues that the ‘courtship period’ – a time when companies can get to know each other – plays a pivotal role in leading a successful deal. Factors such as ‘communication before the merger’, or ‘Future compensation policy’ also are taking up a crucial part of the successful deal, in that they prevent forming of uncertain rumors, the clash between employees which could result in detrimental effect in the deal.

Especially regarding organizational experience, Al-Lahama *et al.* [3] deliver more detailed definitions on the organizational side of the experience, breaking down organizational experience one step further, to general acquisition experience of the acquirer, and pre-acquisition alliance experience with the target firm (acquiree).

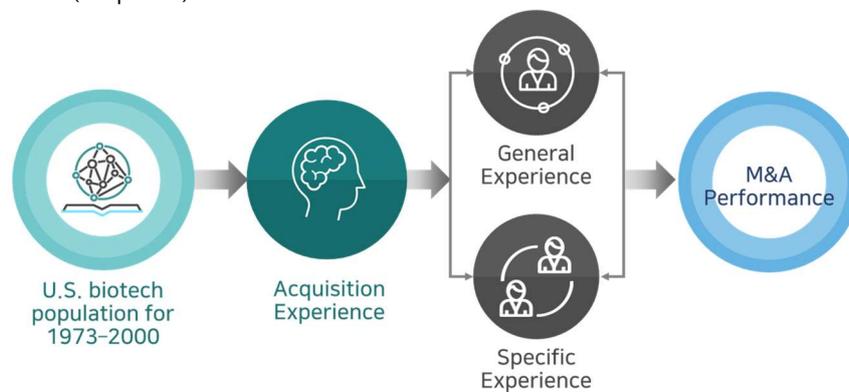


Figure 3. Alahama's framework for affecting factors of M&A performance

Design/ Methodology/ Approach:

From the aforementioned factors, we have piled up quantifiable factors and categorized into 4 sectors, technology, business, experience, and firm size. Specifically, inspired by Al-Lahama’s idea that both general and mutual experience of the firms are important, we divided all influencing factors within each sector into two different groups: general and mutual factors.

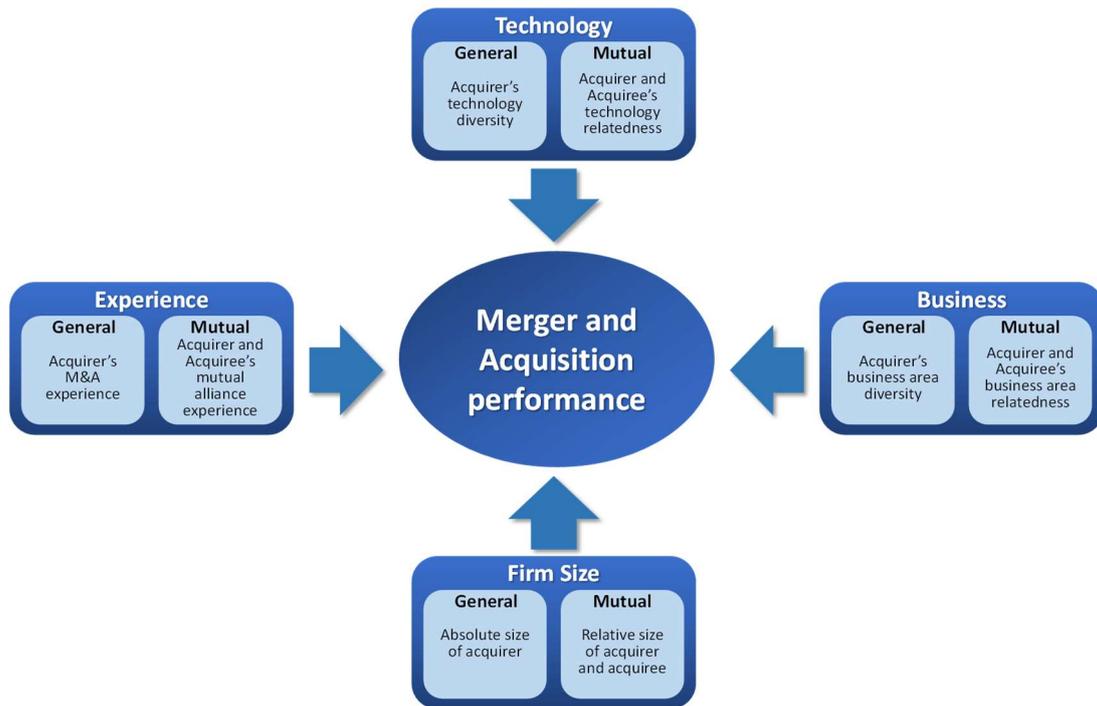


Figure 4. Factors affecting merger and acquisition performance

Summary of independent variables derived from each factor is listed in the table below.

Table1. Summary of (independent) variables

Category	Sub Category	Variable	Description	Reference
Technology	General	Acquirer's technology diversity	Number of acquirer's International Patent Classification (IPC) code	[9]
	Mutual	Acquirer and acquiree's technology relatedness	Proportion of number of common International Patent Classification (IPC) code to number of total IPC code of acquirer and acquiree	[9]
Business	General	Acquirer's business area diversity	Diversification classified into two-by-two matrix of based on broad spectrum diversification (BSD) and mean narrow	[7]

		spectrum diversification (MNSD)		
Experience	Mutual	Acquirer and acquiree's business area relatedness	Proportion of number of common FTC/SIC codes to number of total FTC/SIC codes	[1], [5]
	General	Acquirer's M&A and alliance experience	Numbers of acquisitions and alliances in the 5 preceding years of acquisition	[3]
	Mutual	Acquirer and acquiree's mutual alliance experience	Numbers of alliances between the acquirer and acquiree in the 5 preceding years of acquisition	[2], [3]
	General	Absolute size of acquirer	Market value / Total revenue	[2], [7]
Firm Size	Mutual	Relative size of acquirer and acquiree	Proportion of acquirer's market value or total revenue to sum of acquirer and acquiree's market value or total revenue	[2], [7]

In addition, the outcome of mergers is measured in both financial and non-financial domain, using variables derived from stock value, accounting, patent, and new product factors.

Table2. Summary of (dependent) variables

Category	Variable	Description	Reference
Financial	Stock Value	Acquirer's short-term abnormal stock returns	[8]
	Accounting	Acquirer's Return-on-asset (ROA)	[4]
Non-financial	Patent	Acquirer's patenting speed	[3]
	Product	Number of new products developed	-

Although there have been endeavors to measure outcome with sample cases of M&A (Demirbag,

2007), (James, 2002), (Cloodt, 2006), only a limited number of research, specifically in the biopharmaceutical industry, has provided the empirical evidence by fully leveraging commercial databases. Our study is conducted with large commercial databases such as Medtrack, Wharton Research Data Services (WDRS), GPASS of LexisNexis, each having approximately 240,000, 36,000, and 840,000 sets of data. The regression for the performance will be induced with the equation below, each individual variables representing 8 factors from 4 different sectors.

$$\hat{Y} = b_{TG}X_{TG} + b_{TM}X_{TM} + b_{BG}X_{BG} + b_{BM}X_{BM} + b_{EG}X_{EG} + b_{EM}X_{EM} + b_{SG}X_{SG} + b_{SM}X_{SM} + b_0$$

(Expected) Findings/Results: With the increase in both general and mutual factors of 4 sectors will result in an increment of merger and acquisition performance.

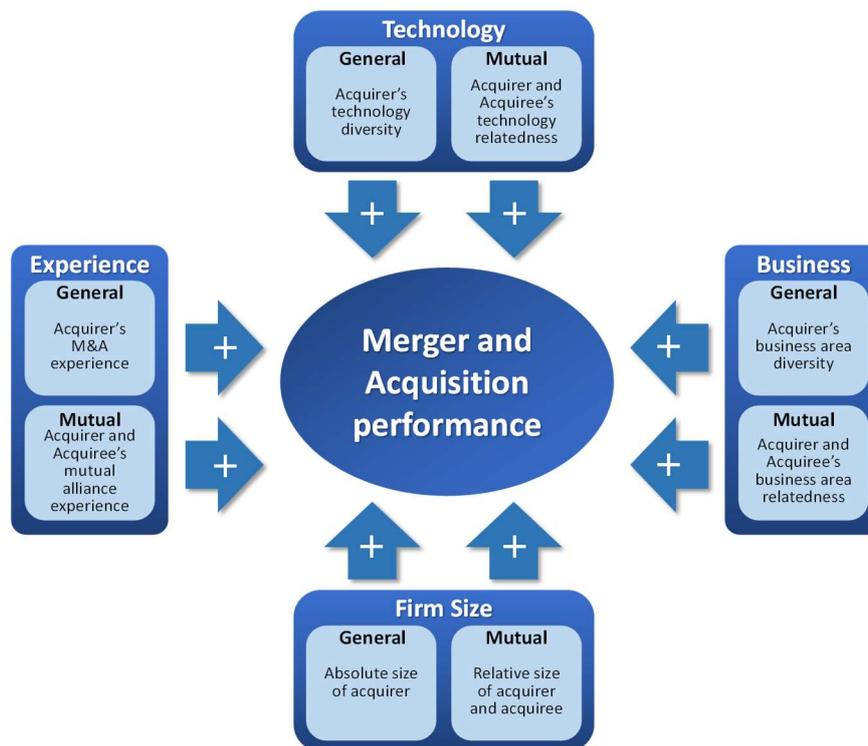


Figure 5. Expected Results

Research limitations/ Implications:

The scope of this study is limited to solely quantitative pre-M&A factors. Post-M&A factors, as well as qualitative factors, and their interactions effects are left for future studies.

This study will help the establishment of the direction of M&A deals, especially associated within biopharmaceutical industry.

Keywords: Pharmaceutical industry, Mergers and acquisitions, M&A performance framework, empirical study, pre-merger factors

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37.

Developing evaluation framework for selecting optimal medical devices

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Abstract

Purpose/ Research Question

The medical device industry is an industry directly or indirectly related to human life and public health. It is a field of health industry whose importance is increasing in preparation for the 21st century. In addition, as the demand for high quality medical devices increases and the development of high-tech medical devices due to technological development accelerates, it is recognized as a high-value-added industry. As the aging population of Korea and developing countries including developed countries, the importance of equipment development and industry is also becoming more apparent. (Jung, Y. A., & Kim, Y. J., 2018)

However, the various variables that exist throughout the medical device industry and other aspects of stakeholders' medical devices are becoming a danger to the development of the medical device industry. Stakeholders are not evaluating the value of medical devices because they are evaluating medical devices using different evaluation methods, with different purposes and uses for evaluating medical devices. In addition, different evaluation criteria may not only increase the period of entry of medical devices into the market, but also reduce objectivity and efficiency of medical devices, which may hinder industrial development.

Therefore, in order for the industry to develop, the evaluation framework that evaluates the subject

medical device objectively and comprehensively should be able to accommodate the viewpoint of stakeholders and take into account various variables.

Stakeholders in the medical device industry need to unify their gaze towards each other and begin with an evaluation framework for medical devices that can be used objectively and universally. An evaluation framework that can be used universally can select medical devices that meet the purpose and characteristics of stakeholders according to the objective evaluation results, and can improve the quality of medical care by improving reliability and efficiency of selection. In addition, when selecting multiple medical devices, it is possible to maximize the benefit of stakeholders by providing numerical comparison results.

The goal of this project is to summarize the commonly used evaluation methods for stakeholders in the selection of medical devices, to complete a general evaluation model and to maximize the effect of medical device selection.

This study presents a general framework for evaluating medical devices to select optimal medical devices. This general framework adds a usability appraisal that has not been highlighted in the evaluation of medical devices to the evaluation frame so as to reflect the purpose and characteristics of the main stakeholders of the medical device industry, so that it can be measured quantitatively. Then, using the proposed framework, evaluation results were obtained on the index of each item of medical device evaluation through literature and questionnaire. Next, AHP (Analytic Hierarchy Process) was conducted against medical device experts, and weights were applied to each item of the indicator.

The order of this paper is as follows. First, we review limitations of research related to medical device evaluation and stakeholders. Then, we review the literature on the theoretical basis of the evaluation system of medical device evaluation methods. Subsequently, a general frame for evaluating the medical device is presented, and a specific indicator system is presented. Next, the result of the survey is quantitatively analyzed according to the frame, and the AHP is performed and a comprehensive evaluation is presented. Finally, suggestions for medical devices based on the analysis results are presented.

Key Literature Reviews

1) Study on existing evaluation framework

There are two main ways of evaluating a medical device. One is to evaluate a single medical technology or a medical device, and the other is to evaluate a number of medical technologies and medical devices.

The method of evaluating one medical device or medical technology can be listed as evaluation methods according to the development period of the medical device. The development of medical devices follows a model of total product life cycle, which is also used by the US Food and Drug Administration to reflect medical device characteristics. However, as the experience of product

testing and use accumulates, the stage of development of medical devices is overlapped or iterative. After entering the market, product evaluations in the market and product improvement through it are continuously made.

In the early stages of invention and prototyping, and in the preclinical stage, technology valuation is carried out and evaluation is being carried out at the clinical stage and the regulatory decision stage (Lee et al., 2016; Lee et al., 2016; Lee et al., 2018, Lee et al., 2018). In the R&D cycle of medical devices, evaluation of medical devices is carried out throughout the entire cycle. However, evaluation of technology value in the early stages of technology development is an opportunity to determine development and clinical trials. It is progressing. Evaluation at the clinical trial and regulatory decision stage is an evaluation of the licensing process of the medical device. Clinical Trial Evaluation is a system to review the efficacy and side effect data and manage the availability of the product to the human body, while the Food and Drug Administration is responsible for the evaluation of the medical technology. It is a system that evaluates the value of the medical technology Korea Health and Medical Research Institute. (Immigration and National Security Agency, 2014) In addition, the appraisal and evaluation agency conducts economic evaluation to determine insurance benefits. The evaluation of the technical value of medical devices does not have an official evaluation method and the evaluation result is used as a reference. The evaluation of the clinical trial and the regulatory decision stage are classified into safety and efficacy, clinical Value and economic value are evaluated individually for each evaluation method.

The product lifecycle model is evaluated after the product is released, but rather than evaluating a single product, methods of comparing and evaluating multiple medical devices or medical technologies are being used. Evaluations were under way to compare medical devices with alternatives in companies and to compare similar medical devices for introduction in hospitals. Several methods for evaluating medical devices are conducting evaluations of medical devices that are appropriate for the purpose and value pursuit of stakeholders. The main stakeholders are the government, the hospital, and the business. From the perspective of stability and effectiveness, the government is evaluating the efficiency and technological aspects of hospitals and the hospitals in terms of user aspect and economics. At first glance, the evaluation of medical device seems to be well done according to the characteristics of each stakeholder, but because it considers only one viewpoint, it has a limitation that it cannot consider the whole value of medical device. Unlike the international trend of medical technology evaluation, Korea's medical technology evaluation system supports decision-making in the healthcare sector, which stakeholders can face acutely, and to consider the form of consideration (Ahn, 2017)

The assessment of a medical device is different in stages and requires different information. The medical device in the hospital needs high quality information on clinical efficacy / efficacy, especially on information on innovative medical devices, but there is no information on clinical data. In Europe, the CE marking on safety and performance of government devices is only available on the market

with a small number of clinical studies, and these studies are not methodologically accurate. This shows how difficult it is to evaluate medical devices in a practical and timely manner in order to share experiences in the field and support decision-making (Boudard, A. et al 2013). In addition, Kazanjian Green has acknowledged that manufacturers usually have limited perspectives in the development process, mainly because they focus on proof of concept. This may result in a lack of information on the user and economic aspects of the device, which may affect the evaluation of the device.

Comparative evaluation methods for the introduction of medical devices various evaluations also have different evaluation results due to different preferences such as the type of institution, medical device and area of introduction that determine the introduction. In this process, the evaluation of the medical device faces considerable uncertainty (Gelijns, A. C. et al., 2013). Rather than thinking about the priorities of different values, it requires the ability to appropriately assign the value of medical devices to various stakeholders, but lacks the means to understand their values to other stakeholders.

Kang Dae-wook et al. (2017) According to the improvement report of medical equipment purchasing management system of hospital affiliated hospitals, the highest selection criterion is the user preference in the survey on medical equipment selection criteria, but only 8% The present standard is less likely to introduce a satisfactory medical device to the user. Usability evaluation is an engineering research methodology that finds out problems and improvement requirements of products by observing and analyzing actual users using actual products (web sites, applications, physical product generics) (Roca, JC et al 2006) Therefore, it is a scientific method of evaluating a medical device based on the user and a method of evaluating the medical device to reflect user preference, which is an important factor in the introduction decision. However, it was difficult to apply the method of evaluating usability directly to the user such as expensive medical device or bulky medical device. However, nowadays, there are some conditions that can be used for the usability evaluation through the companies that have labs that can be applied to the medical technology of the medical device or to demonstrate the medical device, and the necessity of usability evaluation is introduced in various fields . Therefore, the importance of usability evaluation will become more evident in future medical device evaluation.

These limitations can be summarized as the evaluation of existing medical devices makes it difficult to introduce medical devices because clinical data or objective evaluation data about medical devices are not shared. As a result of the limited view, can not do. In addition, comparative evaluations of medical devices with different purposes and perspectives make it difficult to compare superior medical devices because of their lack of objectivity, as well as making uncertainties about the scale of prediction and comparison effects in the development and investment of medical devices. The introduction of medical devices also lowers user preferences, making selection of medical devices more difficult and does not reflect the need for usability evaluation in the medical

device industry.

2. Necessity of evaluation framework

In this way, due to the nature of the medical device industry, the way and purpose of evaluating medical devices by the timing, purpose, system, and various stakeholders are different, generalized evaluation frames are needed to overcome the limits of stakeholders in introducing medical devices. Objective standards are needed to meet the objectives of various stakeholders and to maximize the benefits of each other while increasing efficiency in the distribution flow of medical devices. The medical device industry is growing at a high growth rate and it is one of the most valuable industries in an aging society. (Yoon Jae-jung, 2018) Although the location of high-end medical devices is small in Korea, low-end medical devices are steadily increasing their presence in SMEs. In response to the domesticization of these industries, the government actively supports SMEs and venture companies and also invests in the development of medical devices. If we can verify the excellence of domestic medical devices for high-priced medical devices, the efficiency-oriented medical device industry market will be able to widen the position of domestic medical device companies.

When we consider the need for evaluation frames from the viewpoint of various stakeholders, it is necessary to summarize the necessity from various perspectives in order to construct general evaluation framework.

(1) Necessity of evaluation framework from hospital viewpoint

- ① Economical aspect: It is possible to select medical equipment with high caustic ratio in selecting multiple expensive medical equipment.
- ② Competitiveness aspect: It is possible to improve the quality of medical care by selecting excellent medical equipment and improve the reliability of hospital by enhancing the brand image of the hospital.
- ③ Business aspect: Effective medical equipment selection can reduce business cost.
- ④ Improvement of work efficiency: Actual departments can select the most necessary and effective medical equipment, thereby improving work efficiency and satisfaction with use.

(2) The need for an evaluation framework from a government perspective

- ① Economical aspect: The evaluation of medical devices through the evaluation framework can lower the investment risk of the government.
- ② Competitiveness aspect: It can shorten the time of related processes by integrating various evaluations conducted by the ministries and reduce the introduction of indiscreet medical equipment, thereby raising the competitiveness of the medical device industry.
- ③ Business aspect: By reducing rebate and unfair contracts of medical equipment business, it is possible to create transparent medical equipment introduction market and induce technology competition, which can help development of medical device industry. It can be used to support R & D commercialization such as development of new materials and design technology, core parts and technology development.

(3) The need for an evaluation framework from the viewpoint of the medical device companies

① Economics: Reducing rebates and unfair transactions related to the introduction of medical equipment can lead to investments in medical equipment technology and development.

② Business aspect: It is possible to increase the market competitiveness of domestic medical equipment makers and to lower the entry barriers.

③ Improvement of work efficiency: Contributes to efficient sales strategy by referring to objective evaluation criteria at the development stage or planning stage of medical equipment. In addition, based on the evaluation data, it is possible to improve the product improvement and quality control standards, and to provide feedback on product upgrades and new developments.

Stakeholders are pursuing a variety of benefits based on their own needs and their own interests, but eventually one needs an objectified evaluation frame. Although there have been systematic studies on the individual evaluation in the existing studies, there have been no studies on evaluation of medical devices considering various stakeholders. However, in the field of medical technology, various efforts have been made. Recently, the evaluation frame of the medical technology of the Advanced Medical Technology Association of the United States, which presents the framework of medical technology evaluation considering various stakeholders, We have launched a strategic value-creation program in partnership with LLP to develop principles and approaches to assess the value of medical technology that can be adopted by medical technology companies, healthcare systems, payers, and other stakeholders. There are eight principles of inclusiveness, evidence, cost, specificity, flexibility, participation, transparency, and relevance. These principles are used to assess the value of medical technology effectively and equitably It can be a way to do that. This approach, incorporated into the assessment process, represents four categories of value creation factors:

- Clinical impact: the range of clinical efficacy and health outcomes associated with providing medical technology.
- Nonclinical patient impact: Impact of patient (or carer) on non-medical benefits: patient experience and patient economy (OOP cost).
- Care revenues and cost impacts: The impact of technology on revenues or costs on providers, payers, provider sponsored plans, etc. on bonuses or fines associated with care quality metrics and clinical trial studies and other operational efficiency resources.
- Public and population impacts: The impact of technology on large-scale and employer or public health systems. (AdvaMed, 2017)

The four categories are intended to reflect the views of the various stakeholders and the priorities may vary from organization to organization. A Framework for Comprehensive Assessment of Medical Technology AdvaMed's approach ensures that the appropriate analysis supports value assessment. Stakeholders are interested in evaluating the value of a particular medical technology and benefiting patients, providers and others, taking into account the economic impact of the introduction and all

relevant risks. AdvaMed believes that an effective appraisal process will result in such an analysis of the "value proposition" anticipated. (AdvaMed, 2017)

This approach of AdvaMed resembles the nature of this project. It is a broad framework of evaluation framework that can understand the stakeholder perspectives and satisfy the value factors of stakeholders with the value of the patient as the core.

Therefore, in this study, to overcome limitations of these existing studies, we will present a general evaluation model supplementing and modifying the evaluation framework of AdvaMed. In addition, we will develop and present objective indicators based on existing methodologies to overcome the creation and activation of objective and transparent medical device industry ecosystem through evaluation frame considering various stakeholders.

Design/ Methodology/ Approach

1. Development of a new evaluation framework

In this study, we will approach the evaluation framework from the ecological point of view, reflecting the characteristics of the medical device industry. The medical device industry has a complex structure and relationship among the Korean industries. Here, the stakeholders that form the main axis in the medical device industry are designated as government, hospital, and company. Ideally, in such an ecosystem, the government will lay the foundations for the industry through investment and support, the company will generate technological development and management performance, and the hospital will improve its performance and usability based on this, (Eungdo Kim, Soyoung Kim & Hongbum Kim, 2017), and the results of this research will be applied to other industries and social cultures.

The general model of AdvaMed is derived from the difference between medical technology and medical device, and a suitable model that can be universally used. First, stakeholders should be re-considered in the evaluation of medical devices. As we have defined stakeholders in the past, the main stakeholders in the medical device industry can be thought of as government, hospitals, and businesses.

The value factor for Advamed's comprehensive evaluation frame can be taken into account in the device evaluation frame as follows. The value factors of clinical impacts are influences on the effectiveness, stability and profitability of medical technology. This is because the clinical performance of medical devices and the value factors of medical device technology evaluation are influenced by stability and effectiveness. The nonclinical effect is a value factor for the patient's experience and benefit. The user's position on the patient in the introduction of the medical device is used by the actual user. Of the total number of employees. Care revenues and cost impacts can be categorized as economics related to medical devices as a value factor for costs incurred during the entire medical technology cycle. Finally, value factors related to public and population impacts are similar to the evaluation of stability and effectiveness among the evaluations carried out by the

government as a value factor considering the effects of medical devices. Considering the characteristics of medical technology and medical devices, it is possible to complete the evaluation frame of the medical device having the same purpose and characteristics of the evaluation frame by comparing the value of the stakeholder with other aspects of the industry.

The evaluation frame of AdvaMed takes into account evidence for each of the evaluation methods, which is dependent on the medical technology valuation. The evaluation method that meets the aforementioned principles is applied to various medical technologies. In terms of evaluation of medical devices, clinical performance, medical device technology, stability and effectiveness can be defined as technical meaning, which is a broader meaning, and the usability considering the user's influence and the cost and cost effectiveness of the medical device are evaluated. It can be thought of as economic efficiency. Therefore, when constructing an evaluation frame for a medical device, it can be considered as a technology performance, economical efficiency, and usability based on this concept. This is because the evaluation frame of AdvaMed is modified according to the stakeholders of the medical device industry and the value factor. It is composed of a large frame of medical device evaluation frame, and the evaluation frame is completed by selecting indicators based on these attributes.

It has the characteristics of safety and efficacy, functionality, economics, and usability according to the characteristics of each stakeholder. Classifying these evaluations according to the purpose of each evaluation, evaluates the performance and technology of medical equipment, Evaluation, and usability.

The performance and the technicality of the medical device consist of the evaluations of the technical documents examining the medical device. The broad meaning including these evaluations can be defined as the evaluation of the technicality. In addition, the economic evaluation can be defined as including a number of methods and values for evaluating the economic value such as cost, benefit, and utility of a medical device. And can be defined as a usability evaluation in the sense that it includes evaluations of users who are not yet present in the general evaluation of the medical device.

The major items that make up the evaluation framework are categories that satisfy all the parts required for medical devices in a big meaning including evaluation methods. In addition, considering the characteristics of stakeholders and their value factors, Evaluation and economic evaluation, and the usability evaluation considering user 's aspect was added to constitute a major item of the general evaluation framework.

In order to derive sub-items and indicators of the evaluation framework planned in the previous section, some complementary measures are needed. It is necessary to define an evaluation from a user perspective that has not been used in general medical device evaluation and evaluation of the evaluation frame is not limited to pass or conformity in the past, It is important to be able to

compare medical devices and make it easy to evaluate medical devices rather than difficult ones due to complex analysis. Therefore, in order to achieve the goal of the evaluation framework for the final optimal medical device introduction, it is necessary to evaluate the specific output of the detailed indicators (Output). Therefore, we decided to construct indicators that can evaluate the activities inherent in the project. Especially, the index for usability evaluation which is not included in the general frame and the index for technical evaluation which is difficult to be included in the general frame are added to constitute the characterization index. This structure enables us to add the necessary indicators complementary to the case analysis while utilizing the advantages of the general model presented for the evaluation, and it can be used for analysis of other cases in the future. The indicators that can be subdivided and integrated into the evaluations included in each item are integrated and classified as follows.

2. Development of detailed indicators

In order to derive detailed indicators of the evaluation frame, the following goals were established. The first goal is to find and index the evaluation indicators that reflect the characteristics of stakeholders from three perspectives. The second objective is to classify the indicators that can be used universally and classify them as major items, middle items, and minor items to form the evaluation framework. The third goal is to complete the general evaluation framework by weighting the evaluation indicators through the questionnaire.

Level 1	Level 2	Level 3
Technology (F1)	Performance (F11)	Technology Performance (F111)
		Clinical Performance (F112)
	Utility (F12)	Effectiveness (F121)
		Stability (F122)
Economics (F2)	Cost (F21)	Cost (F211)
		Cost Efficiency (F212)
	Competitiveness (F22)	Domestic Competitiveness (F221)
		Global Competitiveness (F222)
Usability (F3)	Efficiency (F31)	Efficiency of Use (F311)
		Ease of Use (F312)
	Compatibility (F32)	Compatibility of Use (F321)
		Stability of Use (F322)

Figure 1. Evaluation framework for selecting optimal medical devices

3. Research Method

This questionnaire used the method of pairwise comparison in setting the weights. This is a method

of comparing differences in importance between the two characteristics of selected A and B among the various characteristics, and then collecting these pairwise comparisons to identify the difference between all the characteristics. The relative importance of each question-specific component is determined by comparing pairs (one-by-one of each evaluation factor) in terms of their relative impact on the features they contain. The way to compare the two elements is to ask which of A and B is more important (serious) and compare the degree of severity. At this time, the scale of the pairwise comparison used generally has a score between 1 and 9.

For the AHP analysis of the evaluation framework, 23 questionnaires were administered to government, hospitals, academia, and related parties. In order to prevent the concentration of expert group, 5 experts from government, 5 experts from hospital medical equipment, 5 experts from medical equipment, and 5 experts from medical equipment industry were selected, and experts who can represent each stakeholder were selected. The questionnaire was a questionnaire on the priorities of the evaluation indexes of each evaluation framework on the 9-point scale. The results of the questionnaire were obtained by using the Expert choice program, except for the three respondents whose consistency ratio was 0.15 or more 20 respondents were selected and analyzed.

Expected Findings/Results

The future development of the medical device industry is large, but it is incomplete due to the nature of various industries. The existence of diverse stakeholders and the pursuit of different perspectives and values for medical devices can be a dangerous factor for industrial development.

Due to the nature of national authorities responsible for licensing and regulating medical devices, the government places a great deal of weight on the safety and efficacy of medical devices, which can lead to imbalances in investment in medical devices and in industrial development. Due to limitations, the value of medical devices can not be judged properly, and medical device companies are in a difficult environment to gamble from early development to introduction of medical devices due to incomplete medical device criteria. Therefore, it is necessary to accept the viewpoint of stakeholders and evaluate their values properly through an evaluation framework that evaluates the medical devices that are the subject of the medical device industry objectively and comprehensively. Stakeholders in the medical device industry need a point of contact that they can share with each other for medical devices, and the start of it starts with the evaluation of objective, transparent medical devices. By objectively evaluating medical devices considering various points of view, the government can contribute to investment as well as industrial development through objective data including economic efficiency and usability as well as the safety and effectiveness of medical devices. In addition to evaluating the usability, the hospital can obtain various information about the medical device, thereby improving the reliability of the selection of the medical device, raising the efficiency of the introduction, improving the quality of medical care and maintaining the industrial ecosystem through the user- I will play the role. Since the company has a framework that allows stakeholders

to be considered from the initial stage of development of the medical device to the introduction of the device, many things can be considered in various aspects, thereby maximizing profits.

The results of the AHP analysis on the representative evaluation methods presented in the evaluation framework were of different importance for each stakeholder. The high weighting of different evaluations by stakeholders shows that the evaluation frame is composed of evaluations considering various stakeholder perspectives. In general, the deviation of the weight value of the proposed evaluation indicators is constant. In addition, it is possible to construct a characterization index according to each characteristic by analyzing AHP according to the viewpoint of the stakeholder as well as the general evaluation frame presentation.

The weight values from the AHP analysis can be given numerically as a representative evaluation priority and evaluation result of the medical device. It is the merit of the evaluation framework presented in this study that it is possible to confirm not only the comparison of different medical devices but also the excellence of a single medical device.

By including usability assessments that were not included in the general evaluation framework of the device, this study broadened the evaluation base of the device and balanced the evaluation among the stakeholders. Considering that the usability evaluation was a high priority in the survey results, we think that the usability evaluation will become an important factor in the future general medical device evaluation frame.

The evaluation framework for the selection of the optimal medical device should be understood by the stakeholders and the evaluation methods of the medical devices considering these points should be studied to find out the complementary points of each other and to derive evaluation frames that can be used universally. We hope to appreciate the value of medical devices and evaluate objective and transparent medical devices, and hope to be a good development base for medical device industry ecosystem.

Research limitations/ Implications

As can be seen from the results, it can be seen that the priorities of the evaluation indicators according to the viewpoint of stakeholders are all different. Stakeholders are highly aware of the importance of different evaluations according to their perspectives. The fact that the evaluation framework of this study, which is based on the evaluation framework of medical technology, has different priorities for indicators, it can be seen that the indicators of evaluation according to the viewpoint are configured in a balanced manner. In addition, since the timing of evaluation by stakeholders is different according to the distribution flow of medical devices, evaluation method used in evaluation of medical devices such as evaluation and introduction of government before and after development of medical device. The AHP analysis showed that the weight values varied widely depending on the viewpoints and positions of each stakeholder. However, in the general evaluation frame presented in this study, it was found that the indicators had a uniform deviation due to each indicator.

Therefore, it can be said that the narrow framework for each stakeholder has been considered in the evaluation framework from the perspective of all the stakeholders as well as the entire cycle of the medical device. Through this evaluation frame, the government can reflect the characteristics of the medical device on the usability, and the hospital can obtain information on the technical characteristics of the medical device and review the economic aspect. The company can select and concentrate on the medical device from the development of the product, and can analyze the technology.

AHP analysis of each stakeholder's evaluation index was able to analyze the conflicting criteria and the priorities of many alternatives. It does not assert conclusion but it suggests a general framework by analyzing representative evaluations among various evaluation indicators. When using evaluation frame for each stakeholder, it uses the weight value of the indicator that reflects the characteristics of each stakeholder, Can be further increased.

Keywords: Evaluation Framework, Selecting Optimal medical Devices, Technology evaluation, Economic evaluation, Usability evaluation, AHP

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38.

Study on the Prediction of Economic Lifetime for Converging multi-component technology and its Application to Practical Cases for Technology Valuation

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Abstract

Purpose/ Research Question:

This research seeks to answer the questions which often happens to the valuation process:

1. As one of the primary variables in technology valuation, how will the economic life-time of a technology make difference or an effect on the calculation of the finalized market value?
2. In case that the target to value consists of multi-component patents, how will we determine the economic, efficient life-time of the converging technology or packaged technologies?
3. In order to provide a practical guideline to determine the duration of cash flow calculation or the period of potential profitability, will we find real-field valuation cases with a multi-component technology or converging technologies and validate them for applicable technology transfer, investment in kind, technology finance, etc.?

To cope with the issues above, we propose the way to estimate the economic, efficient life-time of the converging technology or packaged technologies of 2 real world cases in ICT medical and finance industry sector, and investigate how much the finalized results of the valuation are influenced with the sensitivity of economic life-time compared with other variables, e.g. calculation of cash flows via sales estimates, discount rate. Technology factor.

Key Literature Reviews (About 3~5 papers):

Until recently, a lot of studies have been tried to explore what determinants would influence the licensing deals or technology value in Biotech Industry [1], and influence factors with priority extracted in AHP process. In addition, the questions on 'How will we determine economic life-time of commercialized target products with multiple patents by technology class?' [2, 8] or 'Will we utilize remaining cited-patent lifetime using the survival curve analysis?' [7] have been raised up, but they did not provide the formulated answer for the determination of economic life-time of a converging technology.

Despite the fact that technology valuation has been widely used for a variety of purposes such as technology transfer, investment in kind, technology finance (investment of VC/angels, guarantee, guarantee), there exists no systematic guidelines for determining input variables of a converging technology, including a case that it maps to multiple IPC and multiple KSIC such that we experience the hardship while determining the economic life-time of the target technology [4]. There has been an effort to numerically suggest the guideline for efficient life-time of a converging technology [3].

Valuation has been regarded as a useful metric to promote the commercialization (technology negotiation for transfer or licensing contracts), in particular in life sciences and biopharmaceutical industry. Once the input variables such as economic life-time and sales estimates and discount rate are determined with royalty databases in the same industry sector, we obtain a single value or lower/upper value in range to refer to in technology marketing or negotiations by relief-from-royalty

method or risk-adjusted net present value method [5, 6].

Design/ Methodology/ Approach:

We introduce two valuation cases performed by Korea Institute of Science and Technology Information, and the 2 technologies (i.e. patents) lies in ICT medical and finance fields, respectively.

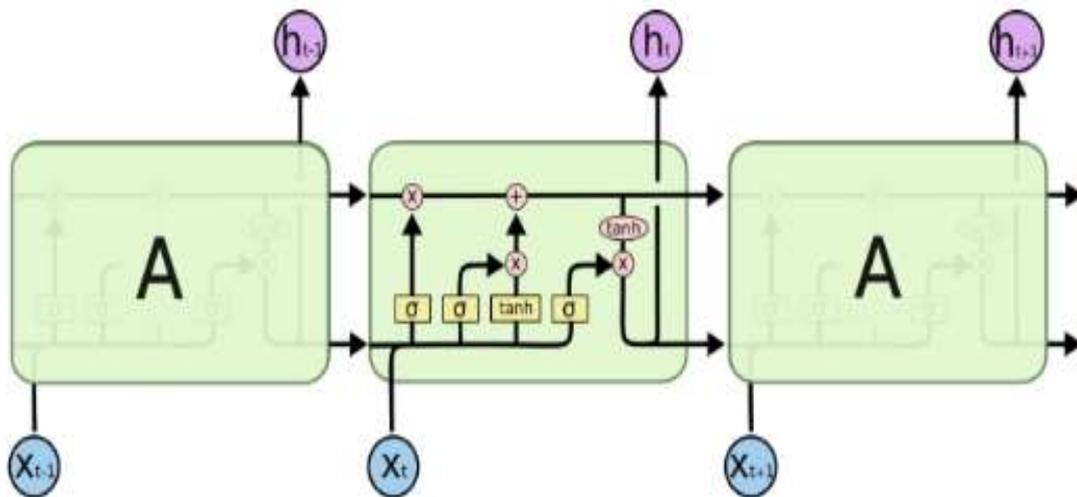
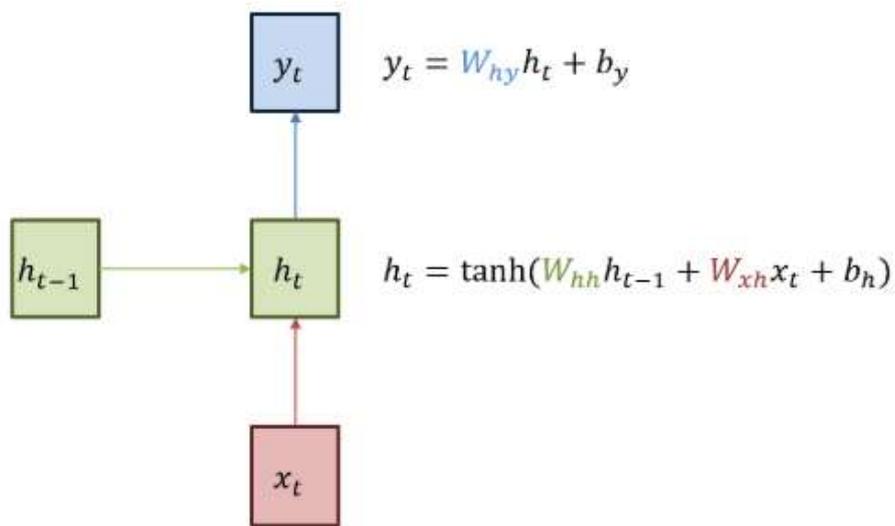
Area	Patent Name (Registration #) : IPC	Application Date (Registration Date)	KSIC code	Detailed Industry
ICT- medical	U Health Care System for Managing Diabetic Patients and Management Method therefor(10-1145142) : G06F, H04W	Nov. 9 th , 2010 (May 4 th , 2012)	C27112	Electric diagnostic and therapy device manufacturing
			G46592	Medical, precision and scientific instrument wholesalers
			J58222	Application software development and supply business
ICT- finance	Securities settlement system using mobile phone and method thereof (10-0875244) : H04W, G06Q	May 15 th , 2008 (Dec. 15 th , 2008)	G46522	Wholesaler of communication equipment and parts
			K66121	Securities brokerage

Then, we trace the way which has been applied to valuation process and realized to actual contracts in technology transfer.

Then, we investigate how the economic life-times of the 2 technologies have been determined and connected to the overall cash flow calculations and royalty-based revenues. In addition, in case of distinct values of economic life-time in other approaches, we investigate how much sensitivity the gap of the finalized technology values resulted from the application of alternative ways leads to or make an effect on.

Design/ Methodology/ Approach:

We introduce RNN and LSTM algorithm to apply the complete sets of input variables (such as economic life-time, sales estimates, discount rate and technology factor) and output variables (such as business value, technology value) so that the minimal information of KSICs and IPCs enables us to provide the estimates or clues of technology valuation results. Hence, we have collected over 50 valuation cases or more by technology class, and when new input values are embedded onto the entire valuation modules, we will be able to utilize the deep learning-based estimates by applying training data in the data.



Further, we intend to reach a framework to invent an intelligent web-based technology valuation system with known data in practical cases. We have known there hardly exists reference guideline for the formulated logic to determine the economic life-time of a converging technology, the sensitivity of valuation results over the change of input variables, the reliable deep learning

algorithm to predict the trustworthy valuation results given input variables are retrieved over the complete valuation data. The validation will be performed on the comparison of DL results and the tracing of upcoming valuation results, where the tolerance is expected within 10% or so.

(Expected) Findings/Results:

<Table> TCT-based descriptive statistics by IPC class

IPC	No. Patents	No. Citation	Mean	Std. Dev.	Var.	Max	Min	Q1	Q3	Q2	Mode
G06F	1,894,371	14,049,181	7.41628	5.5066	30.32269	56	1	3	10	6	3
G06Q	134,686	1,127,508	8.37138	5.79385	33.56865	55	1	4	12	8	3
H04W	94,097	640,857	6.8106	4.99996	24.9996	56	1	3	10	6	2

1) In case of ICT-finance technology, it is related to 2 IPCs of G06Q and H04W, which has 7 and 6 years of TCT mean value, respectively. However, we recognize that the numbers of patents corresponding to individual IPC are 134,686 and 94,097. Thus, we embed the weighting factors of 0.59 and 0.41 and get the final economic life-time as follows. (*1 year gap between TCTs returns the change of $(4.3-2.6)/2.6=65.4\%$ in technology value.)

<p>Economic life-time of multi-component converging technology (ELT-mCT)</p> $= 8 * 0.59 + 6 * 0.41 = 7.18\text{년}$

2) Discount rate also depends to its sub-industry sector, and returns distinct conversion rate of NPV calculation. (*1% gap between discount rate returns the change of $(10.45-8.54)/8.54=22.3\%$ in technology value.)

<Table> Discount rate of ICT-medical converging technology

KSIC code	Ke			E/(D+E)	Kd	WACC
	CAPM	Size RP	Comm. RP			
C27112	11.38%	6.42%	5.1%	0.4	9.09%	13.41%
G46592	8.98%	6.0%	5.1%	0.38	9.53%	12.24%
J58222	8.80%	5.49%	5.1%	0.41	9.56%	12.35%

Research limitations/ Implications:

This research is limited to the deterministic scenario with determination of economic life-time of converging technologies under specific business model and known information in technological characteristics, and unless one of those environmental variables is fixed or known, we will have to assume unspecified constraints so as to move forward the next-staged valuation process.

In order to mutually compare with the valuation results over economic life-time, cash flows calculation, discount rate, and technology factor in sensitivity, we will need to normalize the increments in denominator for the relative comparison.

Considering the practical cases of 2 ICT technologies are appropriately validated in objective, trustworthy valuation model process, then the guideline we have studied so far will be generalized in a solid, logical backgrounds.

Keywords: Economic Life-time of a Technology, Valuation of Converging Technologies, Income Approach, Discounted Cash Flow Method, Relief-from-Royalty Method, Technology Cycle Time, Sales Estimation, Discount Rate, Technology Factor

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39.

**Platform Growth Model:
The Four Stages of Growth Model**

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Abstract

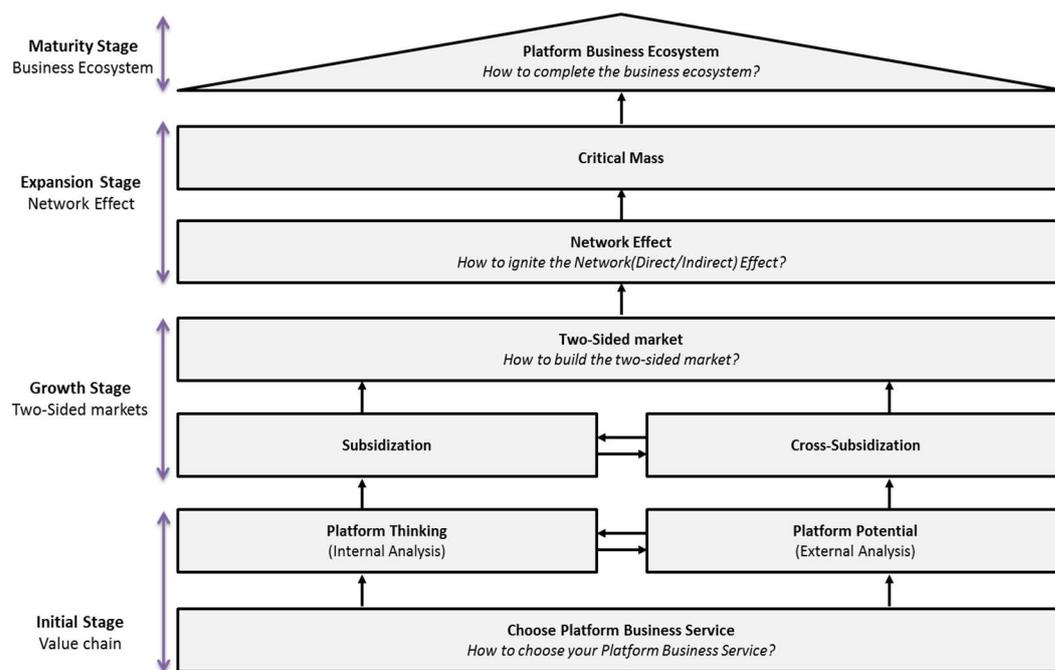
Platform businesses are used widely in both academia and industry, and it is clear that platform businesses and strategies have become crucial research subjects. Indeed, it is hard to discuss innovation and the creative economy without mentioning platforms, which have become the core strategy for dominating the market. In particular, platform businesses, because they have complicated business structures, an accurate understanding of platform business is a key factor in being a successful platform provider. Thus, discussions of platform strategy need to be invigorated, platforms need to be utilised through companies' internal and external analyses, and strategy establishments need to be seriously considered. Corporations are yearning for new innovations and worry about the absence of an efficient and sustainable growth model. However, big problem is that the majority of studies of platform businesses have tended to focus on existing platforms in the market from the perspective of a static approach, not a dynamic approach.

The term 'platform' is used by industrial managers and researchers in various industries (Caillaud and Jullien, 2003; Inoue and Tsujimoto, 2018; Kim, 2016). The reasons for this are that platform innovation and strategy create value mainly through direct interactions between two or more distinct types of affiliated participants, what is known as a two or multi-sided platform. The platform provides an essential, or 'core' function to an encompassing system of use. It is the set of components and rules used in most user transactions (Eisenmann, et al., 2006; Yun, etl al., 2016). Components consist of hardware, software, and service modules, along with the structure of how they fit together. Rules are employed to manage platform participants' activities. Furthermore, a platform needs a 'network effect', which tends to radically strengthen the advantages of the platform itself as well as those for participants. Also, a platform typically emerges in the context of modular industries or industry ecosystems in order to generate revenue and continued growth. Therefore, the platform has emerged as a new, potent organizational strategy for innovation and business transactions in a number of industries. In summary, from a business economic standpoint, a platform business is composed of three theoretical concepts: two-sided market, network effect, and a business ecosystem— which are keys to its systematic nature. A two-sided market enables many industries, especially in ICT, to share product and service offerings a specific place or space (Economides and Katsamakos, 2006; Kim, 2018; Gawer and Cusumano, 2002). In a two-sided market, either direct or indirect network effects emerge through transactions. These are the network effects that one product or service user has on the value of products or services to other users. When network effect occurs, the value of a product or service is basically dependent on the number of its users. Based on the network effect, with creating enormous value and removing barriers to entry in businesses, self-organising, independent, and co-evolution are occurred on the platform. These conditions make the business ecosystem and it makes platform business grow spontaneously.

This research analyses how to build a step-by-step business strategy based on a dynamic approach

that will allow understanding of how the platform business successfully enables a corporation to enter the market and continue its expansion. This research identifies four major stages of platform business (entry stage, growth stage, expansion stage, and maturity stage), and different core elements and strategies exist for each stage in order to understand the life-cycle of a platform business. These serve as the conceptual frameworks with which to build a platform business. The key contributions of this research are as follows. This research presents the core elements and strategies for each of the four major growth stages, so that the platform can construct a successful growth model. That is to say, an accurate understanding of core elements and business strategies at each stage of the growth model is essential for corporations that aspire to become platform providers, as they undertake competitive advantage strategies to create a successful platform business. Therefore, the findings of this study attempt to demonstrate to platform providers how to settle successfully in their respective markets and how to achieve sustainable growth and innovation, while reducing their rate of failure.

<Figure> Platform growth model conceptual framework: House of platform business



Keywords; Platform, two-sided market, growth model, dynamic approach, four stages life-cycle

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40.

Intangible Resources and Internationalization for the Innovation Performance of Chinese Hi-tech Firms

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Abstract

Purpose/Research Question: This study aims to provide better explanation among intangible resources, internationalization and innovation performance of Chinese Hi-tech firms. For this purpose, we examine the relationships between the three intangible resources and innovation performance, and then the moderating effect of internationalization on this relationship.

Key Literature Reviews: (1) Resource-based view: According to the RBV, firm performance are differed primarily by the consequence of differences in a firm's intangible resources as they are valuable, rare, inimitable, and non-substitutable (Barney, 1991; Grimaldi et al, 2017). Among possible intangible resources, the technology, human capital, and reputation are considered to be the three of greatest strategic importance (Gomez- Mejia and Balkin, 2002; Kim & Lee, 2018; Kong & Thomson, 2009; Park et al., 2018). Other scholars, like Grant (1991) and Hall (1992, 1993), have included organizational culture and relational capital in this group of strategic intangible resources.

(2) Internationalization of EMFs: Emerging market firms (EMFs) are increasingly venturing into foreign countries (Buckley et al., 2007; Wang, Hong, Kafourous, & Boateng, 2012). Unlike firms from developed countries, EMFs operate in environments characterized by under-developed institutions that constrain the development of internal capabilities for innovation (Cuervo-Cazurra, 2008; Luo & Tung, 2007). Extant research suggests that firms originating from weak institutional settings expand overseas to seek more efficient institutions (Luo, Xue, & Han, 2010) that may enable them to enhance their innovation performance and global competitiveness. However, the theories in the field of internationalization suggest significantly different predictions regarding whether internationalization is beneficial for EMFs (Sui & Baum, 2014). **(3) Innovation:** Innovation that emerges from a collective process where individuals and firms absorb, assimilate, exchange, and create knowledge (Fischer, 2006) becomes imperative to achieve dynamic capabilities and high performance (Im and Rai, 2008). Under the competitive and turbulent environments, organizations need to innovate faster, better, and cheaper (Swink, Talluri, and Pandejpong, 2006). Thus, increasing the performance in innovation projects becomes a main concern of researchers and practitioners (Brown and Eisenhardt, 1995; Egbetokun, Oluwadare, and Ajao, 2017).

Design/Methodology/Approach: The empirical context of this study is the listed Hi-tech firms in China in the year of 2016. The data for TMT diversity, R&D intensity, government subsidies, overseas sales, number of patents, etc. were collected by analyzing the CSMAR and WIND database. The final sample included a total of 274 Hi-tech firms in China. The hypotheses presented in the study were tested using hierarchical multiple regression analysis. In the first model, we entered only control variables. Then, in the second model we tested the main effects of the three intangible resources on innovation performance of sample firms to test Hypotheses 1, 2 and 3. Finally, in the following model, we entered the two-way interaction effects of each type of intangible resources and internationalization to test Hypotheses 4-1, 4-2 and 4-3.

Findings/Results: The findings of Model 1 that examines the effects of control variables on innovation performance reveal that firm size positively relates to innovation performance at $p < .05$ whereas firm age and industry type did not significantly explain the variance in innovation performance of sample firms. The addition of the main effects significantly increased the explanatory power of the regression model over Model 1. The findings show that all three intangible resources - TMT diversity, R&D intensity, and government subsidies- improve the innovation performance of Chinese Hi-tech firms. Thus H1, H2, and H3 are supported. The interaction effects of internationalization with each type of intangible resources on innovation performance were tested in Model 3, 4, and 5. The interaction between TMT diversity and internationalization of Chinese Hi-tech firms was significantly and positively associated with innovation performance at conventional level ($\beta = 0.289$, $p < 0.1$) (Model 3). Thus, the results support Hypothesis 4a. The findings are also supportive of Hypothesis 4b. The interaction between R&D intensity and internationalization was significantly and positively associated with innovation performance ($\beta = 2.999$, $p < 0.001$) (Model 4).

Finally, Hypothesis 4c, which predicts that government subsidies more strongly and positively influence innovation performance when they interact with internationalization was also statistically significant ($\beta = 1.967, p < 0.001$) (Model 5).

Implications/limitations: The findings of the study lead to some important implications. Firstly, they provide an evidence for the strategic value of intangible resources and its effects on innovation performance. Hi-tech firms should exert every effort to obtain and utilize intangible resources to create and sustain sustainable competitive advantage. Secondly, our results show that increasing effort for internationalization independently doesn't guarantee the improvement in performance. Firms should consider various factors in their internal and external environments and also the complex relationships among factors when they make decision for the investment in internationalization. Finally, prior researches do not explain how internationalization can affect to performance because they mainly focus on direct relationship between internationalization and performance. On the other hand, the findings of this study present how internationalization can intensify firms' performance studies by examining an indirect effect of internationalization on performance. Thus, they complement the limitation of prior researches in innovation.

Like most research, this study has some limitations that raise several questions for future investigation. First, given that this work used secondary data, we relied only on the observable characteristic of the TMT to measure the diversity of TMT. Future studies could utilize different data gathering techniques that enable researchers to collect in-depth data regarding demographic and functional information on upper ranks. Second, we only included the three types of intangible resources that are expected to have strong effect on firms' innovation performance. However, there are some other intangible resources, like reputation and culture, that possibly affect innovation performance especially in the interaction with internationalization. Future studies that explore the effects of those resources might intensify the validity of the findings of this study. Finally, we limited our discussion and analyses to the listed Hi-tech firms in China. The motivation for focusing upon the listed Hi-tech firms was data availability through regularly published, archival source. Future research can examine those effects in different sample will be beneficial to intensify the generalizability of the findings of this study.

Keywords: Intangible Resources, Internationalization, Innovation Performance, Chinese Hi-tech Firms

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41.

How to creat collective intelligence for successful open innovation

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Abstract

There have hardly been previous studies dealing with the possibility of interconversion of the groupthink and the collective intelligence. However, that issue is a critical problem for success of open innovation strategy, because the open innovation strategy without collective intelligence can't guarantee the better performance. So, the goal of this study is to suggest several ways to transform the groupthink into the collective intelligence in open innovation condition. We figure out the effect of 6 well-known capacities through ABM simulations, and compare these results with previous studies.

Purpose/ Research Question: Previous studies have treated the groupthink and the collective intelligence (CI) independently. Only few studies (e.g. Neck and Manz, 1994; Solomon, 2006) argued the possibility of interconversion between them. Actually, there were no clear criteria to distinguish the groupthink and CI. So the first research question is 'how to distinguish the groupthink and CI'. The second research question is related to the interconversion between the groupthink and CI. There are few evidences supporting the argument that the groupthink brings fiascoes to the organization, so it is valid to consider the condition, mechanism and source of the groupthink rather than reckless belief toward the groupthink fiascoes (Hart, 1991). However, several studies pointed out the possibility of interconversion from groupthink to CI (e.g. Hart, 1991; Neck and Manz, 1994; Turner and Pratkanis, 1998a). So, the present study willing to propose how to transform groupthink

into collective intelligence in terms of six-capacities³ (Ahn et al., 2013) for successful open innovation strategy.

Key Literature Reviews (About 3~5 papers): To capture the potential of interconversion between the groupthink and collective intelligence (CI) in the open innovation environment, we should understand groupthink, collective intelligence and open innovation.

(1) Groupthink

Janis' groupthink framework (Janis, 1972) is the most pervasive tool to explain the organizational fiascoes caused by three antecedents. He suggested six representative cases⁴ composed of 4 groupthink cases and 2 non-groupthink cases. From those cases, he captured 7 antecedents, 8 symptoms of groupthink and 7 defective decision making and figured out their linear relationships. Based on Janis' groupthink model, many studies have done in two major stream which are case study and laboratory study. However, following studies couldn't support the entire framework of Janis' groupthink model (Baron, 2005; Hart, 1991; Turner and Pratkanis, 1998a), because of several reasons, such as lack of empirical evidence. Previous studies have tried to solve this problem in three ways. The first way is to modify Janis' groupthink model by adding (or modifying) variables (e.g. Turner and Pratkanis, 1998b; McCauley, 1998, Flippen, 1999) or specific contexts (e.g.; Flowers, 1977; Chapman, 2006; Mok and Morris, 2010). Another approach is more fundamental. They emphasized the importance of organizational dynamics for the exact interpretation of the groupthink (Hart, 1991; McCauley, 1998). However, the number of studies based on the first way (modifying original model) is much larger than second one. So there aren't enough studies dealing with the groupthink on the organizational dynamic perspective.

(2) Collective Intelligence and Groupthink

CI is considered as an effective way not only to get creative knowledge and solve the complex problems by the group of unspecific individuals (McHugh et al., 2016) but also new source of the innovation economic paradigm (Yun et al., 2016). On the perspective of complex system, CI is an emergent phenomenon which is a macro pattern of a system generated by microscopic behaviors and interactions (Schut, 2010). Also, similar to the groupthink, the antecedents of CI have been explored by many previous studies, for example IQ (Ellis et al., 2003; LePine, 2005), communication equality, cognitive diversity (Woolley et al., 2010, 2015), social cognition (Woolley et al., 2010; Curşeu et al., 2013). Based on the previous studies, Spielman (2014) suggested the definition of CI and conditions. In that study, CI consists of the accuracy and credibility of new knowledge or idea, and they are in the mutual reinforcement relationship. In this point of view, groupthink may have low accuracy and credibility than individual knowledge. Also, He argued that diversity and integration

³ inventive, absorptive, transformative, connective, innovative, and desorptive capacity

⁴ Watergate case was added to the original cases in 1982

are the conditions of effective CI. CI requires not only the diverse and independent members, but also integration mechanism of dispersed knowledge.

(3) Open Innovation

There are researches that verified the effect of open innovation not only in business but in different levels of groups. Kratzer et al. (2017) pointed out that companies tend to neglect the internal openness of their employees, when they care the openness in external innovation process based on the survey among Russian companies. Wang et al. (2012) investigated that the impact of open innovation on national level of innovation system. Based on the analysis, they argued that open innovation can reinforce the importance, improve the effectiveness, and diversify the networks of national innovation system. Also, researches on open innovation are conducted in different groups such as university (Kim et al., 2017), collaborative workshop between client and agency (Choi et al., 2018), and global R&D centers (Patra and Krishna, 2015).

Santoro et al. (2018) suggested the IoT based knowledge management system that helps to create an open and collaborative ecosystem, and it improves innovation capacity by exploiting flows of knowledge.

Design/ Methodology/ Approach:

(1) Agent based model

To achieve our research goals, we used ABM⁵ simulation methodology. ABM is an effective analytical tool for explaining complex social phenomena involving numerous and individual interactions and represents a number of computational simulations generated from the agent who have predefined decision making rules (Klimek et al., 2015). Our research model assumed basic behavior of people in the organization, such as learning activity (Levitt and March, 1988), communication, . Under this ABM, we will test six capacity of open innovation.

At the first stage we postulate that organizations are able to be represented by the behavior layer and knowledge layer. In the behavior layer defines individuals in the organization. The knowledge layer refers to the knowledge landscape of an organization at the certain period. To overcome the uncertainty of individual knowledge, we describe the knowledge as stochastic variable.

To replicate open innovation environment, we bring two important factor suggested by previous studies. First, open innovation environment permits to share organization's knowledge and human resource with external parties (Chesbrough et al., 2003; 2007). Also, transforming and integrating the shared knowledge with existing knowledge are unique characteristics of open innovation model (Chesbrough, 2006). Thus, we include 'sharing' and 'integrating' in our research model.

(Expected) Findings/Results:

⁵ Agent based model

Ultimately, we aim to figure out which capacity among the six-capacity can transform the groupthink into the CI effectively. And we will compare these ABM simulation results with the result of previous studies and empirical analysis toward bio-pharmaceutical industry.

Research limitations/ Implications:

Limitations

This research is based on computer simulation, not the empirical data. So, there is a limitation to replicate real world because of the large number of parameters and complex correlations of real world situation. This limitation brings simplification process of research model. These difficulties cause limitations that the model must be extremely simplified.

Implications

This study will bring the effective way to create new knowledge of organization. In terms of successful open innovation, transforming groupthink into CI is an effective way to enhance the organizational performance and creating new knowledge. Especially, CI can enhance the effectiveness of open innovation emerging cyclically (Yun, 2018) and the open social innovation(OSI, (Yun et al., 2017)) enabled by random participants such as UBER and AIRBnB.

Keywords: Groupthink, Collective intelligence, Open innovation, Agent based modeling

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How Big Data Contributes to the Building of Citizen-Centric Smart Cities: The case of Namyangju City in Korea

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ABSTRACT

The recent increase of interest in the ‘smart city’ has led to many studies on this topic. However, there have been a lack of studies on improving the satisfaction of civil services that address the needs and demands of newly migrated inhabitants. In this study, we conducted a big data analysis of the city of Namyangju, an exemplary ‘smart city’ in Korea, from 2009 to 2016, regarding the change in population composition by the influx of new migrants and its effect on the civil service complaints. According to the results of this study, there was a statistical significance between the increase of civil service complaints and the change of migrants by age group. This suggests that the preference for civil services is different for each life-cycle stage. Moreover, the increase in the demands of civil services was different between the migrants within and from outside of Namyangju. This means that there is an expectancy disconfirmation depending on how many civil services are previously experienced. The results of this analysis also suggest the policy implications on the role of local government, to implement smart city policy for the enhancement of quality of life of a city.

KEYWORDS

Smart City, Civil Service Complaints, Life-Cycle Stage, Expectancy Disconfirmation, Quality of Life

1 INTRODUCTION

For the past two decades, ‘smart city’ has become a very important concept for scholars and international communities. The city is an important player in the social and economic sectors as well as in the environmental aspects of future society [1]. The smart city refers to a city in which the inhabitants can access smart services anywhere at any time. Smart cities can provide smart services to the inhabitants through ICT based infrastructure [2]. The purpose of building a smart city is to solve urban problems such as inconveniences and complaints on civil services, transportation and

environmental problems by connecting the ICT-based technology and city's infrastructures, and the final goal is to bring the vitality to the city's urban structure through the efficient redirection of information [3]. Moreover, with the services offered by a smart city, the city managers can also improve a city's competitiveness and inhabitant's quality of life [2].

In recent years, the studies on smart cities have emphasized the anthropocentric approach, in which the needs of inhabitants shall be addressed by solving challenges regarding sustainability in social and economic aspects [4, 5]. Hence, sustainable socio-economic well-being and quality of life are expected to be enhanced by leveraging the ICT in civil services in diverse areas such as transportation system, energy, environment, healthcare and city safety, online education, e-service delivery, smart cities, and human-centric [6]. The successful and effective policy implementation for smart cities is only possible when practical and frequent interactions with inhabitants are promoted with the help of ICT-based smart city services.

However, despite the rapid increase of studies on smart city, there is a lack of study on how to improve Inhabitant's quality of life by providing the needed civil services to the inhabitants. This study aims to carve out the role of local government to improve the quality of life for inhabitants by finding the needed smart city services through the case analysis of Namyangju city in Korea. We draw academic and policy implications for creating the sustainable value for inhabitants by analyzing big administrative data from the city [3].

2 THEORETICAL DESCRIPTION AND HYPOTHESES

2.1. Smart City

While diverse concepts exist, the concept of a 'smart city' is vague and is not always clearly explained. Although it may not be a generally accepted view, a 'smart city' can be classified into the two domains, in which 'hard domain' is ICT-base system such as buildings, energy grids, natural resources, water management, waste management, mobility and logistics [8] and 'soft domain' is non-ICT specific function such as education, culture, policy innovations, social inclusion and government [9].

According to studies on smart cities[10] [11], smart city refers to the smart economy, smart mobility, smart environment, smart people, smart living, and smart governance. These six areas are related to traditional and regional urban growth and development. In particular, these areas are associated with regional competition, transportation and ICT competition, natural resources, human and social capital, quality of life, and participation of citizens in the governance of cities [12]

In addition, 'smart city' is generally accepted as an ideal concept because 'being smart' is regarded as a strategic approach in urban planning. In addition, government and public sectors are leveraging 'smartness' in all areas to distinguish their policies for sustainable development targets, economic growth, and the city's quality of life [9].

This development of a smart city is characterized by the promotion of various civil services that solve urban problems. In smart cities, the advanced ICT infrastructure can be used to bring

innovations in public services sectors such as health, education, city transport [13], and recently green services such as smart grids have emerged to promote a greener city (e.g. Amsterdam's Smart meter service and San Francisco's Urban Eco-Map Service). [3]

In this regard, over the past decade, many countries have made plans to invest their innovation capabilities and have worked to create an environment that supports novel and innovative services to benefit the public and private sectors. The ultimate goal of this investment is to improve a city's quality of life. The inhabitants' quality of life is closely connected to the living and working environment with a positive impact on competition. [14]

2.2 Namyangju City

In the case of Korea for the past decade, the population in the Seoul Metropolitan area have migrated towards satellite town from diverse reasons such as the high and rising residential cost, the ease of commuting enabled by the improved transportation, and the retirement of baby boomers who wish to find comfortable retirement homes. In the case of the city of Namyangju, 15% of the city population has steadily moved from Seoul every year and about 27.34% of the population of Namyangju from 2009 to 2016 was newly migrated inhabitants.

Hence, provided that the new incoming population from the capital area is increasing, there is a high possibility that new form of civil services are demanded due to the changes in the structure of current inhabitants such as age, education, and income. In particular, there is a high possibility that the degree of request for civil services will vary depending on the population structure by age. In addition, the demand for civil services provided by Namyangju may vary depending on the difference in satisfaction between current inhabitants (Namyangju origins) and newly migrated inhabitants (from outside of Namyangju). In other words, there seems to be a difference in the degree of demanding civil services in which the inconsistency can be found in the services experienced in the previous residence and newly migrated residence.

Therefore, the study conducts an empirical analysis on whether the age and regional characteristics of newly migrated inhabitants of Namyangju city (16 districts) from 2009 to 2016 is a causative factor for the increase of civil services complaint.

2.3 Hypotheses

From 2009 to 2016, the total number of migrated population of Namyangju in its 16 districts is 2,017,800, and the 51.64% of them have migrated for residential purposes. This means that the quality of life was a prioritizing factor for the population movement in Namyangju.

According to Tiebout's (1956) theory of migration, people choosing where to live take the civil services they could use into consideration. If they are not satisfied with the civil services, 'voting with their feet' will occur [15].

Among the factors explaining the quality of life and migration, different demographic and socioeconomic groups are affected by the population movement. In other words, while climate

factors and health services are the most important factors for older populations, childcare and education services are the most important factors for households with children [9]. Moreover, according to the 'life course' index, personal characteristics and quality of amenities shall be considered at the same time [16]. The cultural and recreational amenities are the most important aspects for younger populations, but safety and milder climates are important considerations for older college and educated populations. In addition, the human capital has a significant impact on lower migration rates [9]

Therefore, it can be inferred that the demands and the satisfaction of civil services provided by the local governments will vary by age group. In addition, these civil services are likely to be different depending on the changed age composition of newly migrated inhabitants. In this study, we formed the hypotheses as below.

Studies on inhabitant satisfaction for civil services has so far taken into account the demographic characteristics of respondents [17] and personal experience with local governments [18]. However, through the expectancy disconfirmation model, which has been largely studied in the consumer satisfaction to explain purchasing and repurchasing in private sectors. It can also explain the difference in the level of inhabitants' satisfaction with civil services. According to the expectation discrepancy theory, the customer satisfaction is determined not just by the performance of the service but during the process of comparing the performance with the expectation of the consumer [19]. Therefore, if the expectancy discrepancy theory is applied to the satisfaction level of civil services, 'expectation' is defined as the prediction of inhabitants or the prediction of performance of civil services, and 'disagreement' is the quality difference of predicted and expected civil services. It can be assumed that the greater the degree of these discrepancies, the greater the complaints on the civil services.

Hypothesis 1. Inhabitants' preferred civil services will be different by age group as the inflow of migration changes population composition.

In particular, these expectation discrepancies may be observed due to the inconsistency of preference or satisfaction of civil services between people who migrated from within Namyangju and who migrated from outside Namyangju. For example, the expectation for civil services can be very high for the inhabitants who migrated within Namyangju to find a better local environment. In addition, people who used to have convenient civil services before moving into Namyangju could have higher demands for civil services, resulting in the higher expectation discrepancy. This study hypothesizes as shown below.

Hypothesis 2. The demand for civil services will vary by age group between the inhabitants who migrated *within* Namyangju and who migrated from *outside* Namyangju.

3 METHODOLOGY

3.1 Data Collection

Under the mutual agreement with Namyangju city, we have acquired an administrative data set regarding citizen demand reports from the city. In this study, the demographic and sociological data (age, sex, area, reason for migration) of 2,071,800 people who newly migrated into 16 Namyangju districts from 2009 to 2016 are merged to conduct a big data analysis with 541,119 public demands data.

The original citizen demand data included 40 types of demand categories. We extracted demand categories that include more than 1000 requests per month, out of which we further selected the three categories (water quality/ air management, cleaning/recycling management, and advertisement and urban management), which are related to the quality of life.

3.2 Measurement

This study investigates the effect of change in composition of population by age group due to the increase in the number of migrants on the civil service demands in Namyangju from 2009 to 2016. Since the dataset is panel data, a fixed effect model was used to analyze the results, in which each “dong” (district) and “month” are fixed.

To measure the quality of life of inhabitants of 16 districts of Namyangju between 2009 and 2016, the environment-friendly management system, water quality and air management, cleaning, recycling, are used as the dependent variables. The environmental sustainability is an important factor in determining the city’s quality of life, and the environment-friendly policies which can produce more socioeconomic benefits in a smart city are important considerations as well [20].

This study examines whether there is a generational difference in the preference for civil services. Therefore, the independent variables are the proportion of newly migrated inhabitants for each age group (20s, 30s, 40s, 50s, 60s, and 70s) in Namyangju between 2009 and 2016. We divided the number of people who moved into the city (per month) with a total number of people in the age group.

The control variables are the total population of 16 Namyangju districts by each year, number of vehicles owned (as a proxy for household income at the district level), number of inhabitants under 10 years of age, proportion of migrants by sex, reason for migration (occupation, education, family, residential environment, housing, natural environment, and etc.), the number of people migrating in and out of Namyangju every month, and the factors affecting civil service complaints by the year.

4 RESULTS

4.1 Differences in Civil Services by Age Group

Using three dependent variables, we have built three models. Table 1 is the result of these models (Table 1). There is statistical significance in the age-related differences in the civil service demands such as water quality and air management, cleaning and recycling, advertising, etc., which affect the life quality of inhabitants. For example, as the proportion of the 30s migration increases, the number

of demands in water quality and air management civil services has increased significantly. In addition, cleaning and recycling civil services are showing a significant increase as the proportion of the 20s, 30s, 40s, and 70s migration increase. Especially, age group of 40s has the highest increase in demands as the proportion of influx increases. In the case of urban civil services such as advertisements, statistical significance is shown as the proportion of the 20s, 30s, 40s, and 50s increases. Among them, the increase in the proportion of the 30s resulted in the largest increase in the civil services of urban management.

Table 1. Differences in Civil Services by Age Group

	Water quality/ Air management	Cleaning/Recycling Management	Advertising/Urban management
20s	55.47* (-31.99)	89.32*** (-20.96)	81.76*** (-22.74)
30s	135.78** (-63.6)	234.05*** (-41.66)	214.37*** (-45.2)
40s	-29.03 (-91.36)	307.28*** -59.85	174.91** -64.94
50s	70.4 -77.42	131.38** -50.71	113.07** -55.02
60s	29.44 -55.54	-9.59 -36.38	-17.34 -39.48
Over 70s	29.4 -55.54	61.72** -28.32	81.95 -30.72
Monthly by Region-Male	-467.1*** -176.67	-510.73*** -115.73	-532.30*** -125.56
Monthly by Region-Female	139.2 -162.49	-330.73*** -106.44	-190.55* -115.49
Migration within Namyangju	-0.24 -0.76	-0.12 -0.49	0.09 -0.54
Migration outside of Namyangju	-0.27 -0.76	-0.14 -0.5	0.09 -0.54
Population under age 10	2.18 -8.23	-13.63** -5.39	-12.75** -5.85
year by region	8.78	26.74***	-7.28
Total Population	-14.73	-9.65	-10.47
Year by region	-10.41	2.88	32.41***
Nbr. Vehicles	-9.19	-6.02	-6.53
Year	1.93*** -0.45	3.16*** -0.29	-.73** -0.32
Reason for migration	Yes	Yes	Yes
fixed effect	dong, month	dong, month	dong, month
# of obs	1595	1595	1595
# of group	16	16	16
within R-sq	0.1077	0.3548	0.0706

Note1: *** means significant <0.05 level, ** means significant <0.01 level, and * means significant <0.001 level.

Note2: () means standard error.

The number of environment-friendly civil services increases in the 30s and 40s rather than 60s or 70s. This analysis suggests that the differences in demands and satisfaction with the services

provided by the local government vary by age group, as emphasized in the “household migration” and “life course stage” to describe the quality of life and migration of inhabitants.

In particular, the demand for environment-friendly civil services showed a significant increase as the proportion of the 20s, 30s, 40s migration increased *within* Namyangju, whereas migration from *outside* Namyangju showed a statistical significance in terms of the proportion of 30s and 70s. This shows that there might be a difference in service demands based on *within* and *outside* migration. Therefore, in the next subsection, we investigate the frequency of demands by age group in these two migration types.

4.2 Expected disconfirmation in civil services

In this study, the expectancy disconfirmation model is also applied to the satisfaction of civil services. Inhabitants who migrated to the city from *within* Namyangju and *outside* of Namyangju may show an inconsistency between expectation in civil services and actual services experienced. The results of our statistical analysis highlight the difference between the demand and preference of civil services of the two groups (See table 2 and 3).

Table 2. Expected disconfirmation in civil services: Migration within Namyangju

	Water quality/ Air Mgmt	Cleaning/ Recycling Mgmt	Advertising/ Urban Mgmt
20s	221.33*** (-82.09)	241.47*** (-54.8)	227.21*** (-58.44)
30s	266.47*** (-93.63)	334.75*** (-62.5)	309.58*** (-66.64)
40s	105.54 (-124.91)	369.60*** (-83.38)	369.45*** (-88.91)
50s	40.37 (-99.96)	80.14 (-66.73)	166.89** (-71.16)
60s	53.06 (-68.23)	-23.64 (-45.54)	32.58 (-48.56)
Over 70s	24.94 (-50.24)	59.50* (-33.54)	71.57** (-35.76)
Monthly by Region	-555.39**	-552.4***	-723.14***
Male	-228.13	-152.28	-162.39
Monthly by Region	-243.81	-549.6***	-544.72***
Female	-238.63	-159.29	-169.86
Population under age 10	0.77 -8.05	-9.65* -5.37	-14.47** -5.73
Every year by region	14.89	21.20**	-2.97
Total Population	-14.33	-9.57	-10.2
Year by region	-14.36	2.3	29.76***
Nbr. Vehicles	-903 2.06***	-6.03 3.07***	-6.43 -.79**
Year	-0.44	(,29)	-0.31
Reason for migration	Yes	Yes	Yes
fixed effect	dong, month	dong, month	dong, month
# of obs	1,595	1,595	1,595
# of group	16	16	16
within R-sq	0.1102	0.3319	0.0704

Note1: *** means p-value < 0.05, ** means p-value < 0.01, and * means p-value < 0.001 level.

Note2: () means standard error.

The demand for water quality and air management civil services increased significantly when the proportion of the 20s and 30s migration *within* Namyangju was high, and when that of the 30s and 50s migration were significantly high among the group of people who migrated from *outside* Namyangju.

Table 3. Expected disconfirmation in civil services: from outside Namyangju

	Water quality/ Air Mgmt	Cleaning/ Recycling Mgmt	Advertising/ Urban Mgmt
20s	-20 (-43.44)	61.53** (-28.73)	39.85 (-30.96)
30s	377.28*** (-108.61)	441.86*** (-71.82)	377.80*** (-77.4)
40s	79.32 (-194.48)	445.55*** (-128.61)	62.76 (-138.6)
50s	350.13* (-187.6)	325.23*** (-124.06)	114.82 (-133.69)
60s	22.4 (-124.13)	-131.33 (-82.09)	-104.71 (-88.47)
Over 70s	108.95 (-118.6)	339.00*** (-78.43)	265.87*** (-84.52)
Monthly by Region	-943.64**	-941.90***	-881.67***
Male	-376.79	-249.18	-268.52
Monthly by Region	-281.01	-397.84**	-158.47
Female	-280.16	-185.28	-199.66
Population under age 10	-1.35 -8.04	-13.57** -5.31	-8.83 -5.72
Year by region	20.29	24.60***	-17.13*
Total Population	-14.14	-9.35	-10.08
Year by region	-18.22**	7.29	34.42***
Nbr. Vehicles	-9.08 2.35***	-6 3.29***	-6.47 -.73**
Year	-0.43	-0.28	-0.31
Reason for migration	Yes	Yes	Yes
fixed effect	dong, month	dong, month	dong, month
# of obs	1,595	1,595	1,595
# of group	16	16	16
within R-sq	0.11	0.34	0.07

Note1: *** means p-value < 0.05, ** means p-value < 0.01, and * means p-value < 0.001 level.

Note2: () means standard error.

In term of the demand for cleaning and recycling civil services, all age groups (20s, 30s, 40s, 50s, 70s or above) who migrated from *outside* Namyangju showed statistical significance compared to the age groups (20s, 30s, 40s, 70s or above) who migrated *within* Namyangju.

In the case of urban civil services such as advertisements, the demand increased significantly among all the age groups except 60s in the *within* migration group, while the demand was high only among 30s and 70s in the *outside* migration group

In sum, we found significant differences in citizen demands based on categories of demands, and

whether or not they are moved from *within* or *outside* of the city. People from *outside* of the city tend to demand more “cleaning and recycle management,” and people from *inside* of the city tend to request “advertising and urban management.” We observed interesting findings among different age groups and citizen demands. When the influx of 20s *within* the city were relatively high, the demand for “water quality and air management” was significantly high. Citizens who are over 70s, who migrated from *outside* of the city tend to have higher demand towards “cleaning and recycle management” when compared to the same age group who moved *within* the city.

5 DISCUSSION AND CONCLUSION

In Korea, due to rising house prices in Seoul and the ease of commuting in the metropolitan area, many people are moving into the metropolitan area each year for better quality of life and well-being. Namyangju City, located in the metropolitan area also predicts that a new population will continue to flow in according to the “2020 Namyangju City Basic Plan.” Therefore, population change due to urban growth as well as changes in the age distribution, education, and income level of the inhabitants are expected to result in increased demands for civil services to local governments. In particular, ICT technologies, the essential technologies of smart cities, are expected to improve the quality of life by predicting inhabitants’ needs ahead of time and by providing appropriate civil services to inhabitants.

Given a need to improve the credibility of local governments in order to gain support for implementation of smart city policies, the current studies on smart cities have insufficient considerations in these aspects. Many governments use big data analytics for understanding citizen demands on health, transportation, safety, energy, and education in order to carve out personalized service to citizens [2][21]. Especially since policy decision-makers are required to closely understand citizens’ demands in real time as implementations of smart cities increase [7].

In this study, we examined the effect of inhabitants’ migration and population composition on the civil services by analyzing seven years urban growth data of Namyangju, which is an exemplary city that pursues smart city implementation in Korea. According to the results of this study, the age composition of migrants showed that there are age-related differences in environment-friendly civil services. In particular, the demand for environment-friendly civil services increased as the proportion of 30s and 40s migration increased compared to any other age group. In addition, we found that there is an expectation disconfirmation about civil services between migrants who moved *within* Namyangju and from *outside* the city. The Namyangju origins’ demand for “advertising and urban management” are highest in 20s, 30s, 40s, while the demand of the migrants from *outside* the city is high for “cleaning and recycling management” among older age groups (30s, 40s, 50s and 70s). This study has practical implications for policy decision making. High volume of citizen migration might be from the construction of large-scale housing development. We have provided empirical findings on citizen demands depending on their age and types of migration. City decision makers can plan human resource arrangements to meet citizens’ demands appropriately by redesigning

administrative priorities based on our data analytics results using longitudinal pane data from the city.

Some limitations should be addressed. We used aggregated data in district level regarding inflows of population by age and type of demands in order to abide by privacy regulations. Therefore, we were not able to consider other factors related to population inflows and demands that require more granular level of data sets.

ACKNOWLEDGMENTS

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43.

Paradox of Long Tail Effect in Smart City: Analyzing Citizen Complaints

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Purpose/ Research Question:

1. To requires a new policy system that is appropriate for the network policy process environment
2. To examine internet's long tail pattern on public policy
 - 1) using big data of civil complaints.
 - 2) case is Namyangju city, one of local governments in Korea.
 - 3) focusing on citizen's participation in public policy;

both phone and internet base channel to get complaints from citizens.

3. Research Question

Does the internet channel exhibit a less concentrated distribution of citizens' complaints?

Relevant Literature Reviews:

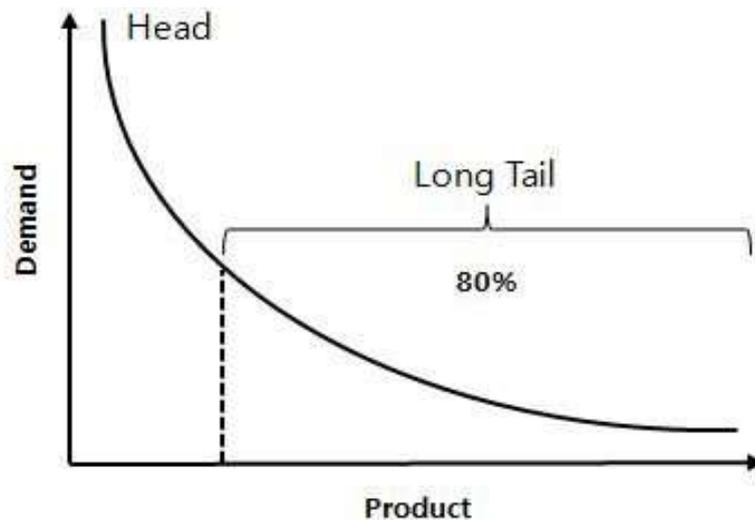


Figure 1: Long tail in Internet-based cultural industry

Source: Anderson (2004, 2006)

Long tail perspective on citizen participation

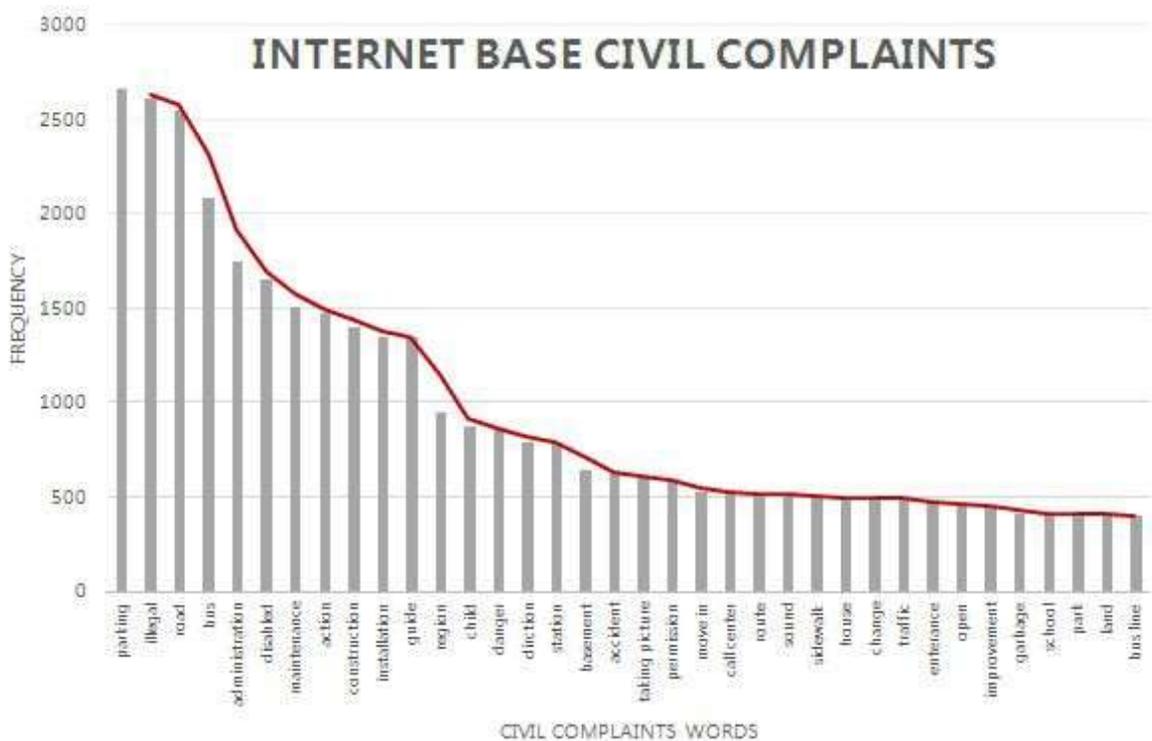
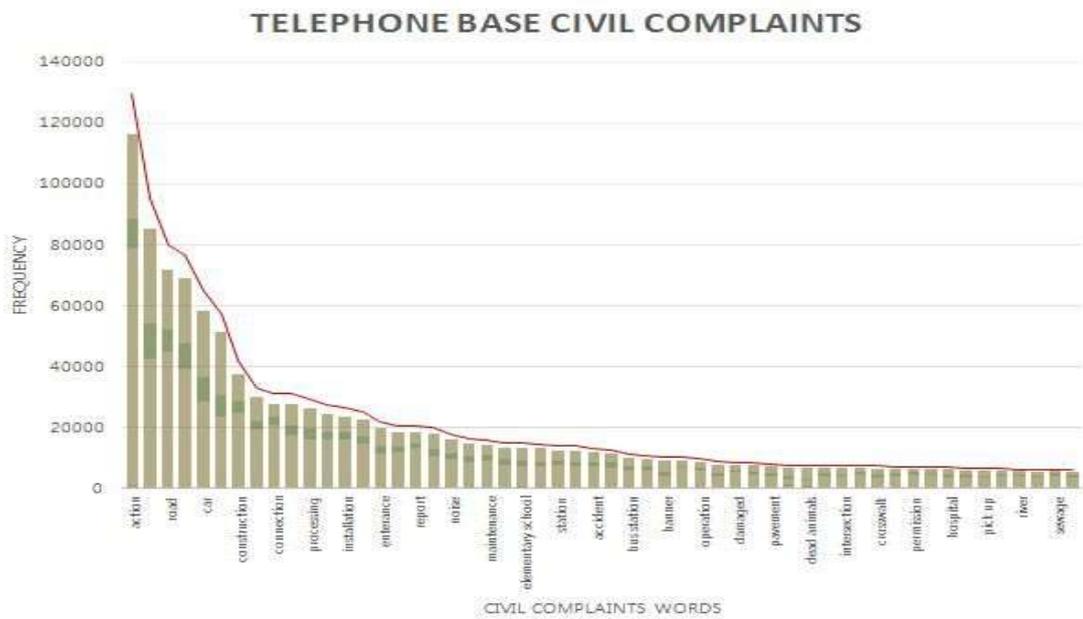
- 1) long-tailed economic model can be applied to the public sector to provide a new perspective on citizen participation (Habermas, J. 1984; Downs, A. 1957; Brynjolfsson, E., Hu, Y., & Simester, D. 2011.)
- 2) Citizens' policy participation (niche group) through the Internet
 - * the Internet has become a public domain to express their opinion
 - * public opinion formation is fast and online participation is quick.
 - * the Internet has minimized the cost of citizen participation in the public sector
 - * Internet search engines have made it easier to find policy engagement niche groups
- 3) Internet long-tail policy participation has expanded various social agenda.
- 4) Online activity is called citizen participation in virtual communities. It has contributed to expanding citizen participation by the niche group of the Internet long tail policy participation.

Design/ Methodology/ Approach

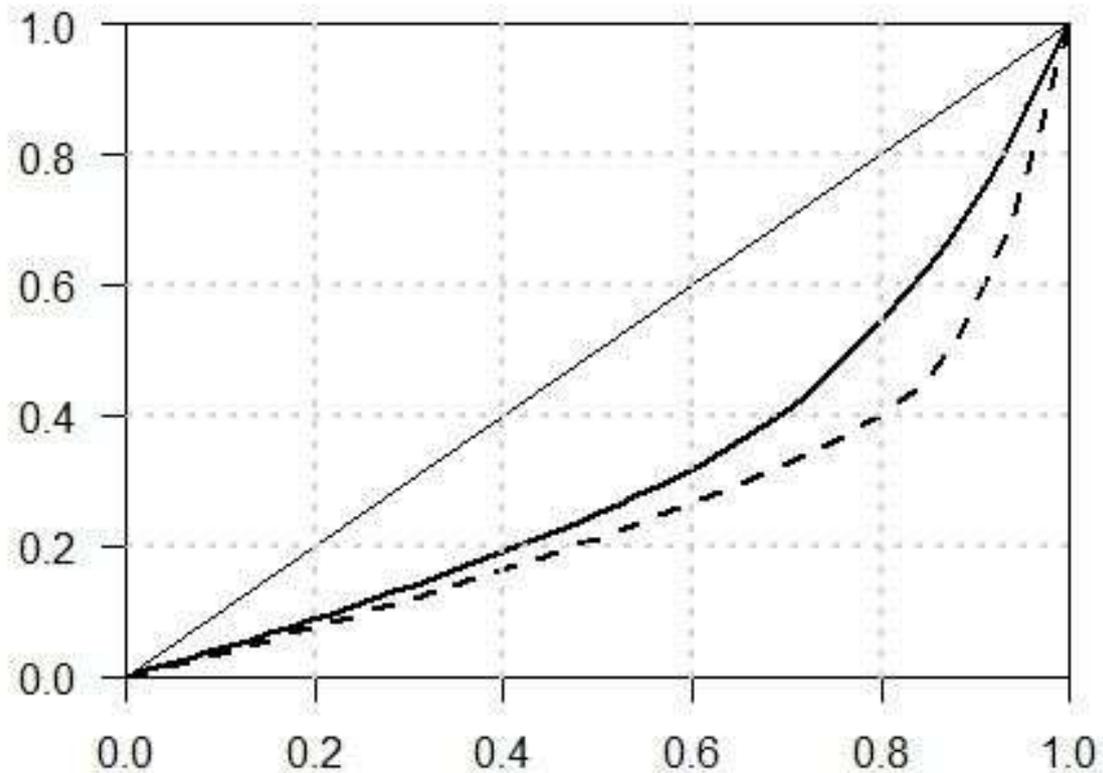
- 1) Namyangju city in Korea having the population of 670,000, this research analyzes the determinants affecting the urban residents' perceptions and derives policy implications.
- 2) The city get the citizens's opinion through internet and phone channels; 8272 phone based citizen opinion channel and Saeol internet based channel (website).
- 3) The 8272 is started from Jun 2006 and Saeol is operated from August 2008. To meet the equivalence of data, the study period was selected from August 2007 to December 2016.
- 4) Text mining

- * 6,273,816 words from phone base and 462,700 words from internet base are generated.
- * after eliminating numbers, signs, and overlapping words, a total of 60 and 48 unique words were extracted in each channel.

Findings/Results:



Research limitations/ Implications:



- 1) The internet channel's Lorenz Curve lies above the phone channel's Lorenz Curve, implying that internet channel exhibits a less concentrated distribution of civil complaints than the phone base.
- 2) Gini Coefficient for the internet channel (0.36) is lower than that for the phone channel (0.48). From the Lorenz Curve, one can easily obtain the percentage of total civil complaints generated by the bottom 80% civil complaints
- 3) Two tools do not allow us to conclude whether such a difference is statistically significant.
- 4) Need additional analysis to verify what kinds of citizens' opinions are reflected and changed in actual policy. In particular, it is necessary to clarify the concept definition such as citizens' opinion, complaints, questions, petition, request and citizen participation as showing in the channel.

Keywords: Long Tail, Big Data, Smart City, Citizen Opinion, Internet Base Civil Participation

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44.

Graduate school education for regional innovation

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Abstract

Purpose/ Research Question:

In graduate school education in Japan, the main purpose was traditionally to train basic researchers. With the aim of pursuing Western countries after the Meiji Restoration, it was fully valuable and functioning as the way of higher education was to form the academic foundation as strengthening the national strength. Since the Meiji Restoration, Japan, which has won the status as an advanced country after about a hundred years including the period of high economic growth after World War

II, has reached the stage to utilize social infrastructure created during the economic growth period and academic base. Turning around, the present situation in Japan is stagnant in economic scale growth due to the bubble economy and its collapse. The response to that situation by dragging thought in the economic growing period has been resulting in social distortion and in the disparity between urban and rural areas in Japan. Japan has become a mature and stable society utilizing the infrastructure accumulated during the economic growth period and the background of society is rapidly changing. And the way of thinking needed at this stage and the way of human resource development should be different. Based on that idea, we rethought the way of graduate school education in mature economic society and especially felt the need for the definition of new doctoral human resources required in local society and the need to educate them. "Graduate School of Regional Innovation Studies" was then established in Mie University in April 2009. Based on the authors' experience, this study considers that the way of graduate school education that is required in society that shifted from economic growth stage to economic maturity stage and the significance of utilizing graduate school education for reeducation of persons who have work experience especially. Based on my educational experiences at the Graduate School of Regional Innovation Studies of Mie University, I introduce my idea such as "what is regional innovation needed for Japan" and "how to educate and empower human resources who create regional innovation."

Key Literature Reviews (About 3~5 papers):

1. Papers showing doctoral education in graduate school¹⁾.
2. Papers showing formation of economic structure and social infrastructure in Japan²⁾.
3. Papers showing regional innovation and its utility^{3),4),5)}.

Design/ Methodology/ Approach:

In this study, the educational records at the Graduate School of Regional Innovation Studies of Mie University was analyzed. It was evaluated the content of research in the doctoral course and the utilization of the research results after graduation, especially focus on students who entered while having work.

(Expected) Findings/Results:

This study appears the definition of "regional innovation needed in an economic maturity stage following an economic growth period" and clarifying its social value and importance of regional innovation. Then, it will be summarized that the author's idea on the logics and way of doctoral education to build up human resources who bring the regional innovation in a mature society.

Research limitations/ Implications:

This study is based on the experience of the creation of graduate school at Mie University where

the author was involved and the experience of the activity at this graduate school. For this reason, it is not accompanied by the universality that it is the event occurring throughout Japan. Japanese universities have been established based on the concept and structure of universities established in Europe or the United States. It is no doubt that the talented people educated at Japanese universities and accumulated in Japanese society played an important role in Japan's rapid economic growth and infrastructure development. However, from the standpoint of Japan, which has changed from follow-up type to leading type (pioneering type), the corresponding reform of university education has not been done sufficiently. Although this study is just one effort at Mie University, it shows the necessity and the valuable logics of education for educating the doctoral human resources required at the stage of transition from the economic growth stage to the mature society with based on our actual results and experiences. This study is not limited to mere report examples, and shows the fundamental theory on the transformation required for higher education in response to the change when the follow-up type economic growth society (nation) becomes a mature society. I hope that many related researches will be conducted starting from this research.

Keywords: Graduate school education, Regional innovation, Matured society

Reference (examples):

- 1) Toward a more perfect university, Jonathan R. Cole, 2015 Public Affairs New York
- 2) Japanese Economic Development, Theory and practice, Third Edition, Penelope Francks, first published 2015 by Routledge
- 3) A review of (almost) 20 years of regional innovation systems research, David Doloreux & Igone Porto Gomez, *European Planning Studies*, Volume 25, Pages 371-387, 2017
- 4) Regional Innovation Systems in Policy Laboratories, Andreas Pyka, Matthias Mueller and Muhamed Kudic, *J. Open Innov. Technol. Mark. Complex.* 2018, 4(4), 44
- 5) How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation, MinHwa Lee, JinHyo Joseph Yun, Andreas Pyka, DongKyu Won, Fumio Kodama, Giovanni Schiuma, HangSik Park, Jeonghwan Jeon, KyungBae Park, KwangHo Jung, Min-Ren Yan, SamYoul Lee and Xiaofei Zhao, *J. Open Innov. Technol. Mark. Complex.* 2018, 4(3), 21

45.

Regional innovation by practical method to the local situation

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Abstract

Purpose/ Research Question

The process of grasping and solving regional challenges is deeply tied strongly to the regional characteristics, so it is often very difficult. Therefore, in order to promote things reasonably and rationally, it is considered that performing logically according to one model becomes a clue to implement solutions. We assume that methods derived from such a model must be reasonable and convenient in practice. Based on such a viewpoint, we suggest the process model from the extraction of regional challenges to the implementation of measures.

1. grasp of current situation, 2. problem recognition, 3. item enumeration,
4. sorting, 5. problem extraction, 6. detailed investigation, 7. target selection,
8. measures planning, 9. carry out

The flow from 1 to 9 above is based on the experience of community association activities and disaster prevention volunteer activities or various kinds of duties, especially the experience of teaching and taking examination instruction as a teacher. That shows the process model for the situation of each region or each student to resolve each problem as a practical method.

Although a process of extracting challenges are often neglected, it is an important process that also affects implementation of subsequent measures, and it is not just highlighting the problem. Backgrounds and relationships to be noticed in planning countermeasures are strongly linked to each other, so consideration should also be made as various conditions in the solution process. For this reason, if the method of extracting the problem is mistaken, the countermeasure will be forcibly proceeded without grasping the relationship of stories and things, and not only cannot be implemented smoothly, but the countermeasure itself may be canceled.

In this way, the process image of the challenge extraction process and the process of formulating the solution will be an extremely important position in solving the regional problem. Conversely, if we can model problem extraction and solution process, many people will be able to make the solving process of regional challenges more familiar. Therefore, in this research, first, based on the process model from challenges extraction to implementation of measures, we apply the regional approach of action and consider it. In other words, we show a process model of regional innovation (solution of regional problem) and attempts to verify whether it conforms to the actual case. As some examples, I will pick up Yahatacho-naka association (tsunami evacuation training etc.) and Misugicho-Taro district (abandoned farmland revitalization plan etc.) in Tsu city.

Key Literature Reviews

Michael Crogelas and colleagues collected 50 models that are simple, practical, easy to understand, and systematic methods as a framework thinking method (decision-making model). With respect to its necessity, they said, "By using the model, it becomes possible to simplify the structure and transition of the trouble and to be able to focus on what is really important" in " Visual Three Minute

Thinking¹⁾". Likewise, we also considered that it is possible to model tasks and problem solving to some extent, we decided to show the flow of thinking by process model and image model.

Tim Brown, famous for design thinking, tells the importance of the human center in innovation, and the work of design thinkers is to help people reveal the inner needs that people have not noticed themselves. They focus on three factors: insight, observation, and empathy²⁾. In the process model, when filling out a worksheet, these three elements are satisfied. By writing out on the page, information sharing becomes possible and it is possible to create a situation where all participants can tackle common problems.

Clayton M. Christensen et al. said, in their book "Job Theory", that to respond appropriately to consumer needs, "We should pay attention to jobs and jobs that customers want to clean", and by paying attention to the story behind it, we need to find a way to resolve jobs more satisfactorily³⁾. In the process up to task extraction, it is important to see things with a job theoretic idea. In the process of extracting tasks, circumstances, backgrounds, circumstances, etc. of the surroundings should be visible. This will lead to resolution of the problems that follow and will continue smoothly and reasonably.

After casting a model diagram of the value creation network, Yashiro wrote about open innovation in "Innovation Management". It seems that it can be defined as "innovation promoted by properly collecting and utilizing the source of value creation (information, knowledge, capability) without limitation⁴⁾".

According to Chesbrough et al., "Innovation promises growth and productivity expansion to society, and it raises expectations for a high standard of living and its improvement", and "Open innovation is the dynamics of such innovation "If it is to speed up and smooth, it is not a waste to strive to better understand it," concluding the editing of "Open Innovation⁵⁾". As they say, if it is open innovation to successfully incorporate every element existing in the surroundings, it is just open to extract problems and to solve them by involving the surroundings Is not it innovation?

The problem-solving process is highly likely to require people in various positions and knowledge which is not well known by some previous researches^{6),7),8)}.

Methodology/ Approach

If the process model that the author myself have worked out is suitable for the reality and it is highly adaptable, already existing various success stories adapt to the process model it fit nicely. The conformity of the author's experience and research to the process model is based on my own idea, so even if it is high, it is a natural result. However, matching with cases by others is not always highly adaptable. At that time, it is necessary to consider whether it can be coped with by fundamentally not matching the model, or by correcting or eliminating / supplementing inappropriate parts due to partial nonconformity.

If the usefulness of the process model is recognized and modeling up to concept sharing succeeded,

it would be sufficient that a work frame could be created to confirm practicality. When doing the framework, we express with languages and write on each item considering to visualizing both visible things and invisible things.

Findings/Results:

Depending on the difference between the authors and others' sense, the fitness to the model is primarily dependent, which confirmation is required.

First, we must show the ideas by our examples of activities at Yahatacho-naka association and Misugicho-Taro district as actual examples. For that reason, we will preferentially discuss them and confirm conformity to the model. If it is a model or frame that is created from a third party perspective and objectivity is guaranteed sufficiently and conformity can also be confirmed, it should be possible to adopt it as a training material or as a teaching material at the educational site.

Research limitations/ Implications:

By modeling and presenting regional challenges extraction and the solution process for regional innovation, efforts for regional challenges become more familiar to more people. Not only that, it seems that we can propose the approach as an easier form, framework. However, depending on the level of content to be tackled, it is impossible to declare how far models, frames, and methods fit. Also, due to regional differences and various obstructive factors, it may not be possible to adapt to each situation, each region. At least, it is significant to show clues to the solution by a model visualized as a form for regional innovation as a vague concept. In other words, by showing a direction from the fumbling state, it becomes possible to share concepts with others, and it can be used not only in practice but also for training and education.

By doing so until the attempt to make it into a framework, it will eventually carry out the following actions. First, create a simple and easy-to-accept model diagram and briefly describe concepts and processes. Secondly, we try to create a work frame based on that model. Third, we pick up past success stories, apply them to the work frame, and check whether the process leading to problem resolution can be shared among those seeing the model by work frame. As derived from these, ultimately, database creation and introduction of AI make it possible to calculate the solution and some proposals may be made with input of required items.

Keywords: process model, framework, practical method, regional issues, regional characteristics, regional innovation

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46.

**Opening the ‘black box’: The mechanism and effects of board power hierarchy to green
governance performance
——moderated by the corporate mission**

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Abstract

Purpose/ Research Question

Green governance is the only way to build a community of shared future for mankind. Enterprises are one of the main bodies of green governance, but existing researches concentrate more on the macro level rather than the micro level, namely, the power hierarchy of the governance subjects and its influence on decision-making as well as implementation of green governance strategy. In fact, regional economic development and corporate mission jointly restrict the green governance decision of the board of directors. Besides, power hierarchy exists in the board and affects the decision-making of the board. However, there are few literatures concerning this field. As a result, this paper explores the mechanism of the impact of board power hierarchy on green governance

performance through the influence of green governance conducts under the mediating effect of corporate mission and regional economic development. To interpret this mechanism, this paper introduces situational embeddedness theory and relational contract theory and also adopts "structure-conduct-performance" paradigm and hierarchical analysis method. Overall, this paper aims to build a theoretical model of the influence of board power on green governance performance at the micro level and to guide corporates to improve green governance performance from multiple dimensions including corporate mission, board's team building, and green governance conducts.

Key Literature Reviews:

Green governance can not only solve environmental problems but also improve economic performance of corporates, as a result, it plays a significant role on the sustainable development of mankind. The concept of 'The union of nature and man' of green governance advocates inclusive development of man and nature (Li, 2017a). According to 'green governance guidelines' (li, 2017b), green governance is a public affairs activity with the goal of building ecological civilization and achieving social sustainable development. And this activity is coordinated by governing body, governing methods and governing mechanism. Nowadays, green governance has become a new governance pattern of promoting environmental protection and business success (Amran et al., 2016). Corporates, the main body and key actors of green governance, should improve the structure of green corporate governance and practice the concept of green governance in assessment, supervision, information disclosure and other aspects. At present, researches on green corporate governance are mainly focused on the behavioral guidance

and corresponding economic performance of enterprise green management practices influenced by enterprise strategy (innovation strategy, green innovation strategy, etc.), but seldom pay attention to the core role of the board, the policy-making organs, in green corporate governance.

As the center of corporate governance, board of directors influence corporate strategies and corporate performance deeply (Forbes and Milliken, 1999). In the structure of corporate green governance, the board of directors should be responsible for the effectiveness of green governance (li, 2017b) to ensure the science and implementation of green governance regimens. In terms of the role of board of directors on corporate governance, present researches mainly focus on the effects brought by the characteristic of horizontal structure of the board of directors (personal experience of board members and composition of the board of directors, etc.) instead of that of vertical power hierarchy of the board based on individual competence. Moreover, according to relational contract theory and disorder pattern theory and under the cultural context of 'Imperial power politics' and 'Authority obedience' in China, the formal power structure of the board and the informal power formed based on personal competence and charm (He and Huang, 2011) jointly affect strategic decision-making and further, organizational performance. Therefore, the study of green governance

conducts of the board should take the interaction between the formal power hierarchy and the informal power hierarchy of the board into consideration. Additionally, the existing research paradigm of "structure-performance" fails to reveal the process of board conducts and its acting mechanism (Pettigrew, 1992), which leads to the bias of theoretical research conclusions. Compared with the former, the research paradigm of "structure-conduct-performance" (SCP) consists better with the realistic logic of the role of the team of the board on governance performance (Xie et al., 2013). Jaffar AH and Amran A (2017) divide green governance behaviors into three categories based on corporate strategy: 1) Non-Compliance Strategic Behavior (NC) (e.g. nonconformance to institutional pressures related to green management practices); 2) Compliance Strategic Behavior (C) (e.g. compliance to institutional pressures related to green management practices); and 3) Beyond-Compliance Strategic Behavior (BC) (e.g. company voluntarily goes beyond institutional pressures related to green management practices). Therefore, it is necessary to include process variables (Jaffar AH and Amran A, 2017) in the path of the influence of the power structure of the board on the performance of green corporate governance, that is, green governance behaviors, such as the formulation of green development strategy and decision-making of environmental protection behaviors. Besides, according to the theory of situational embedding, enterprises are region-rooted (Pfeffer and Salancik, 1978). Different levels of regional economic development restrict the concept of regional green governance and the richness of resources, and thus affect the green governance conducts of the board. Meanwhile, the strategy formulation and resource allocation of the board of directors (Cochran et al., 2008) are bound to be constrained by corporate mission when implementing green governance (David, 1989). Based on the above analysis, this paper believes that as a decision-making institution of corporate governance, the governance conducts of the board have an important impact on green corporate governance performance. And the research paradigm of "structure-conduct-performance" is better consistent with practical logic. As a result, based on the paradigm of 'structure-conduct-performance', this paper builds a cross-layer adjustment mechanism model, into which corporate mission, formal and informal power hierarchy of board of directors, green governance conducts and regional economic development level are introduced. Through this model, this paper aims to explore the mechanism and impact of green governance performance of the board on green governance performance under

the moderating effect of regional economic development and corporate mission.

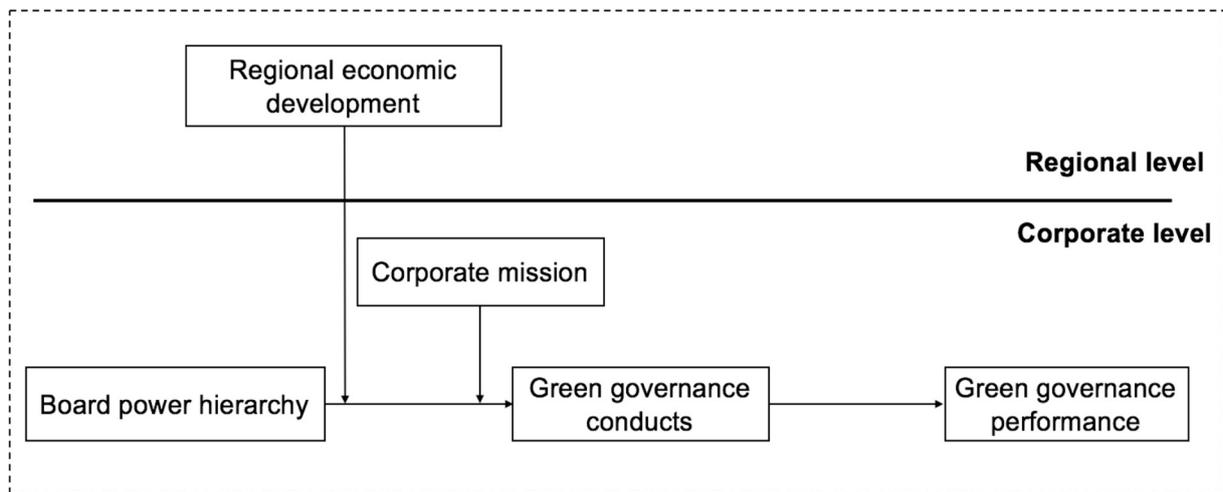
Design/ Methodology/ Approach:

1. Research hypothesis

Based on green development theory, scene embedding theory and relational contract theory, this

paper argues that the formal power hierarchy and informal power hierarchy of the board (He and Huang, 2011) determine the governance conducts of the board, and the power hierarchy plays a vital role on green governance performance through the board social responsibility committee, green investment decisions and CEO's implementation of strategic decisions. Additionally, the implementation of green governance by the board is constrained by corporate mission (David, 1989). As enterprises are region-rooted (Pfeffer and Salaneik,1978), different levels of regional economic development restrict the concept of regional green governance and the richness of resources, and further affect the green governance conducts of the board.

Based on the above analysis, we build a mechanism model as shown in Graph 1, and put forward Hypothesis 1-5 as shown in Table 1.



Graph1. The Mechanism diagram of the effect of board power hierarchy on green governance performance through green governance conducts

Table1. Research hypothesis

H1	The board power hierarchy is positively correlated with the green governance conducts.
H2	The green governance conducts are positively correlated with green governance performance.
H3	Green governance conducts play a mediating role between board power hierarchy and green governance performance.
H4	Corporate mission positively moderates the influence of board power hierarchy on green governance conducts.
H5	Regional economic development moderates the influence of board power hierarchy on green governance conducts across the layer.

2. Main variables

This paper takes Chinese listed companies from 2015 to 2017 as samples. According to David's nine-factor analysis (David, 1989), corporate missions are interpreted by collecting the public annual report of listed companies, website home page and other public information. Corporate missions are assigned and graded by methods of content analysis and document coding. The main variables and their measurements in this paper are shown in table 2.

Considering the particularity of Chinese situation and the science of index selection, this paper builds a green governance performance index system based on the 'green management guidelines' put forward by Weian Li and the division of the index system of Chinese listed company green governance index through second-hand data.

Table2. Main Variables

Variable Type	Variable Name	Abbreviation	Measurements
Dependent variable	Green governance performance	GGP	The performance of corporate in green system certification, clean audit, pollution control, environmental violation punishment, social responsibility and so on
Independent variable	Board power hierarchy	BPH	Coefficient of variation of power structure of board members
			The Gini coefficient of the number of board members who take part-time positions of executives
Mediator variable	Green governance conducts	GGC	The ration of environmental cost to the total cost of the corporate
			Green strategic conducts ^a
			Establishment of social responsibility committee
Moderator variable	Corporate mission	CM	Corporate mission1.0 (Shareholder interests first), Corporate mission2.0 (Customer interest first), Corporate mission3.0 (Stakeholder interest first), Corporate mission4.0 (Social value first) ^b
	Regional economic development	REL	The natural logarithm of GDP in the province where the company is headquartered.
Control variable	Education level of board	EDU	The average number of board members' highest degree.
	Age of board of	AGE	The standard deviation of the age of board member

directors		s.
Proportion of independent directors	IBR	The ratio of the number of independent directors to the size of the board of directors.
Board incentive	BI	The natural logarithm of the remuneration of the first three directors.
Number of board Meeting	NOB	The number of board meetings held within the year .
Equity concentration	EC	The sum of the shareholding ratios of the top five shareholders.
Corporate type	CT	The value of state-owned enterprises is 1 and that of private enterprises is 0
Corporate age	CA	The number of years from the year of registration of the company to the time set by the sample
Corporate size	CS	The natural log of the company's total assets
Year	YEAR	Based on 2015, Year16 and Year17 are set as virtual variables.
Industry	IND	Dummy variable.

Note:

- a. According to Jaffar AH and Amran A (2017) , corporate green governance conducts are divided into three categories based on its strategy: (1) Non-Compliance Strategic Behavior (NC) (2) Compliance Strategic Behavior (C) (e.g. compliance to institutional pressures related to green management practices); and (3) Beyond-Compliance Strategic Behavior (BC). Set NC=-1, C=0, BC=1. Conduct comprehensive scoring for the disclosed green governance behaviors of enterprises.
- b. According to the 9 elements of corporate mission put forward by David (1989), corporates which reveal information concerning each of the elements (customers, products or services, location, technology, concern for survival, philosophy, self-concept, concern for public image, concern for employees) in public report will be encoded as 1, otherwise be encoded as 0. Then, the scores of each element of corporates are counted as the total scores of the corporate mission. Then the corporate mission is further classified.

3. Theoretical model

Based on the above assumptions, this paper constructs theoretical models as follows:

Table3. Theoretical modes

Hypothesis	Theoretical modes
H1	$GGC = a_0 + a_1BPH + \sum a_{i0} controls + \varepsilon$ (Model 1)
H2	$GGP = b_0 + b_1GGC + \sum b_{i0} controls + \varepsilon$ (Model 2)
H3	$GGP = c_0 + c_1BPH + \sum c_{i0} controls + \varepsilon$ (Model 3-1) $GGP = d_0 + d_1BPH + d_3 * GGC + \sum d_{i0} controls + \varepsilon$ (Model 3-2)
H4	$GGP = d_0 + d_1BPH + d_2CM + d_3 * GGC + \sum d_{i0} controls + \varepsilon$ (Model 4-1) $GGP = e_0 + e_1BPH + e_2CM + e_3 * BPH * CM + e_4GGC + \sum e_{i0} controls + \varepsilon$ (Model 4-2)
H5	$GGC_{ij} = \gamma_{00} + \gamma_{01} * REL + \gamma_{02} * BPH + \gamma_{03} * REL * BPH + \sum \gamma_{0i} controls + \varepsilon$ (Model 5)
Total factor model	$GGP_{ij} = \gamma_{00} + \gamma_{01} * REL + \gamma_{02} * BPH + \gamma_{03} * REL * BPH + \gamma_{04}CM + \gamma_{05}CM * BPH + \gamma_{06}GCC + \sum \gamma_{0i} controls + \varepsilon$ (Model 6)

(Expected) Findings/Results:

1. To set up the measurement system of corporate mission.
2. To establish the measurement system of green governance conducts.
3. To set up the construction of the theoretical model of corporate mission, board power, green governance conducts and governance performance.
4. To examine the effect of corporate mission on the decision-making of board's green governance conducts and the effect of green governance conducts on green governance performance under the adjustment of external governance scenario, namely regional economic development.

More specifically, this paper expects that regional economic development and corporate mission have important influences on board green governance conducts and green governance performance: when a firm is situated in the area where regional economic development level is higher and corporate mission of this firm is at higher level, the board is more likely to conduct positive green governance behavior and make decisions conducive to environmental protection to gain better green governance performance.

Research limitations/ Implications:

1. Currently, the measurements of corporate mission in China are based on classic foreign literatures and public disclosure information. However, foreign measurements are not necessarily suitable to the context of China to some extent. Therefore, a scale suitable for Chinese situation should be developed, and questionnaire should be adopted in future research.
2. The creation of green governance performance cannot be separated from the joint participation of other personnel in enterprises. In future studies, governance and management should be combined. In particular, employees' participation should be considered, and a multi-stage intermediary model should be adopted.

Keywords: Board power hierarchy, Green governance conduct, green governance performance,

corporate mission, regional economic development.

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The construction of the AI model of medical beauty tourism marketing - from the perspective of brand

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Abstract

Purpose / Research Question:

Medical beauty tourism is both an emerging industry and a popular travel trend in development. It is believed that the integration of medical beauty sector and tourism industry of Taiwan would have quite a significant economic impact on the markets across the globe.

The research is to study the effects on the development of applications, innovations and the dynamics of the incorporation of online platforms into integrated medical beauty tourism industry and questions of promoting sales; applying artificial intelligence and virtual reality to the products of growing e-commerce platforms, the improvement of user experience given much easier access to product information and well-designed user guidance to boost sales and consolidate the ties of strength between industries based on the theoretical constructs. The research also explores the business models of medical beauty industry.

Key Literature Reviews:

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Design / Methodology / Approach:

- Research Approach

The research applies Task-Technology Fit Theory (TTF), Theory of Reasoned Action (TRA) and the Long Tail Theory as the foundations, questionnaire as the technique and Structural Equation Modeling (SEM) to conduct the statistical analysis.

The research approach is organizing and summarizing collected data from the methods of measure, tally, calculation and description, and etc., to present insights and information that are easily be understood for a collection of complex data and statistical methods with graphical representation.

1. Structural Equation Modeling (SEM) is merely a statistical method assessing specific variables and assumptions of the models.

2. Structural Equation Modeling (SEM) cannot be used to create an original theory or knowledge.

3. The research is a work of organizing research data, fundamental theories, scholars' experience and embedding the method of Structural Equation Modeling that enables the researcher to build a conceptual model and draw independent conclusions in this paper.

- Research Subject

To find the critical factors of the application of integrated artificial intelligence and virtual reality in the medical beauty tourism industry, the research subjects are separated into two sample groups.

1. Current employed workers in the medical beauty industry.
2. Consumers have direct shopping experience in the sector.

- Questionnaire Design

To ensure the quality, completeness and objectivity of data, the questionnaire is designed after established theories and papers.

- Research Theory

- Task-Technology Fit

Tasks: The broad definition of tasks is the efforts turning inputs into outputs taken by individuals (Goodhue, 1995).

Technologies: Technologies are defined as tools used by individuals to perform tasks (Goodhue, 1995).

Security: Extend the aspect of information security such as facility security, operational security, data security, content security and information resistance to examine the theories in this paper on the base of the DeLone and McLean Model of information System Success Model (DMISM).

Performance Impacts: Individual performance is treated as a variable. The theory does not include the aspect of behavior.

Utilization: Utilization is defined as the effect of users' views on the "fit" or the support towards tasks. This observed support and the improvement of user experience increases new information technologies' user engagement.

- Theory of Reasoned Action, TRA

Belief: The specific outcome of performing a particular behavior predicted by individuals.

Attitudes: The attitude is defined as the feelings towards the performed behavior.

Behavior Belief: Outcome of specific behavior expected by individuals.

Subjective Norms: Motivation of behavior perceived by relevant groups or individuals.

- The Long Tail Theory

Demand: Support of long-tailed retailers' effects on consumer behavior towards product demand.

Sales: Online platforms metrics' effects on consumer behavior towards sales.

Findings / Results:

The conclusions of the research could serve as a reference for the integration of medical beauty and tourism industry using artificial technology to point out the potential opportunity for the emerging business ecosystem. The concepts of the research might be applicable to relevant industries in various countries.

Research Initiations:

1. The research uses "strategy analysis" to project the future competitive edge of Taiwan in the global market.
2. The research subjects are limited to workers in the medical beauty industry and only consumers have relevant shopping experience in the sector by random sampling.

3. The questionnaire is designed solely for individuals' responses of workers in the medical beauty industry and consumer have relevant shopping experience in the sector.

4. The research might be subject to inaccurate data sampling, therefore, the conclusions of the research might need further proofs to be applicable to different industries.

Keywords: Medical beauty tourism, Artificial intelligence, Task-Technology Fit, Theory of Reasoned Action, Structural Equation Modeling.