

Open Innovation and Multi-Homing of Delivery Platforms: Comparative Study of Cardiff, Daegu, and Nanjing

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Abstract

This paper aims to answer the following research question:

What is the difference in the open innovation and multi-homing of the smart delivery industry among Cardiff, Daegu, and Nanjing according to the maturity of restaurant industry of the capitalist economies they belong to?

By comparing open innovation and multi-homing of delivery platforms of the three cities representing different alongside the maturity of restaurant industry in capitalist economies, the evaluation dynamics and focal points of delivery platform industry in addition to the reality and theoretical points of three-sided delivery platforms can be found. This study is based **on interview method in combination with participatory observation** on deliverer, customers, and restaurants of the three cities; 1) Cardiff with matured restaurant industry from a long history of capitalist economy, 2) Daegu with unmatured restaurant industry based on late developing capitalist economy, and 3) Nanjing with the growth of restaurant industry based on short capitalist economy history. **Findings of this research** are as follows; 1) Existing industries in capitalist economies can disturb the growth of delivery platform industry; 2) Multi-homing motivates high labor state of deliverers, the acceptance of restaurants by customers, and customer surplus; 3) Motivating open innovation in delivery platforms can maintain at high level after maturity stage. **The study draws the conclusion** that the balance between open innovation and multi-homing of three-sided delivery platform is the way to the sustainable development to conquer the negative effects of gig economy.

Keywords

Delivery-Platform, Open Innovation, Multi-homing, Deliverer, Restaurant, Customer

1. Introduction - Background and Research Question

With the Internet of Things (IOT), big data, artificial intelligence (AI), blockchain, and numerous other new technologies, the fourth industrial revolution and second information technology revolution are rapidly emerging [1]. However, despite the arrival of the fourth industrial revolution, productivity is slowing due to exhausted opportunities and the world transforming with entrepreneurship decline occurring as an exponential paradox [2-4]. Consequently, to conquer the growth limits of the 21st century capitalist economy, both technology and creative business models combining technology, market, and new business process software are needed [4-7]. A representative new business model in the fourth industrial revolution is the online-to-offline (O2O) platform, which is not a converted model but a new phenomenon [8]. Among the O2O platform business models is the smart delivery business model or industry, which is receiving significant attention with regards to growth speed, gig economy, and global expansion [9, 10]. Therefore, this study focuses on the smart delivery platform industry.

1.1. Literature review on platform

With the emergence of O2O ordering and delivery, many independent restaurants are competing for customer orders placed via online smart platforms [11, 12]]. Platforms, including O2O, provide algorithms that match service providers and users, reducing transaction costs for employers/clients to such an extent that they can facilitate micro-transactions and provide services that diminish or mitigate risks of market transactions [13].

Platforms have several possible sources of positive consumption externalities: 1) from a direct physical effect of the number of purchasers; 2) from indirect effects that increase consumption externalities; and 3) from positive consumption externalities that arise for durable goods [14]. According to the rivalry between platform participants and control exerted by diverse industry platform owners, there are four types of platforms: 1) low rivalry and tight control, such as Handy, along with Deliveroo and Uber Eats in Cardiff, Wales; 2) high rivalry and tight control, such as Uber, as well as Meituan and Ele.me in Nanjing, China; 3) high rivalry and loose control, such as Airbnb;

and 4) low rivalry and loose control, such as Couchsurfing. Additionally, there are also BemIn Rider, Yogiyo, and BemIn in Degu, Korea between 1) and 2) as shown in Figure 1 [15].

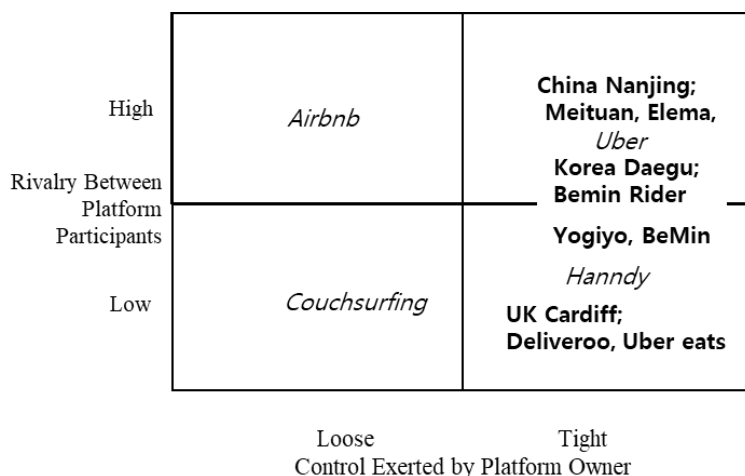


Figure 1. Delivery platform typology in terms of control and rivalry degree

Source: Authors' creation based on models of sharing economy platforms [15]

Through diverse O2O platforms, the transaction cost paid by potential buyers and sellers searching for each other is reduced, and information asymmetry between buyers and sellers is decreased [16-19]. Digital platforms offer the connection between previously unmatched demand-side and supply-side participants through innovative value creation, delivery, and capture [20]. Platforms are here understood as interfaces that mediate transactions between two or more sides, such as networks of buyers and sellers or complementors and users [21].

Acceptance of O2O food ordering platforms by customers, restaurants, and deliverers requires perceived usefulness and ease of use, similar to other information technologies [22, 23]. As a result, platform businesses require strategy shifts from controlling to orchestrating resources, from optimizing internal processes to facilitating external interactions, and from increasing customer value to maximizing ecosystem value [24]. Important factors influencing restaurants that use O2O food delivery platforms include delivery or logistics conditions and word-of-mouth (WOM) marketing reflected in the number of reviews and ratings in addition to food prices [25].

While most studies on O2O food delivery platforms have focused solely on the technological merits of mobile Apps, some research addresses the moderating role of moral obligations in meal preparation, customers, restaurants, and deliverers [26, 27]. Diverse smart delivery platforms have been studied in terms of big platforms, such as Uber Eats from US, Meituan & Ele.me from China, and Deliveroo from UK and EU, and smaller companies from different countries, such as Zomato & Swiggy from India, IFOOD from Brazil, and BemIn and Yogiyo from South Korea, showing that overall customer satisfaction on online food ordering platforms depends on various factors [28-30]. O2O food delivery platforms have powerful effects on restaurant sales through "Ranking" Apps like Expedia, which was not introduced to the restaurant sector before the launch of smart delivery platforms. The impact coincides with customer recommendations on platforms, which become a basis of trust from customers on the food delivery system, especially with the increasing significance of healthy food choices in casual dining restaurants [31-33].

Customer recommendations on O2O platforms are also diverse, including collaborative similarity such as choices from the same groups of customers, preference similarity like customer ratings, and change similarity like the trajectory of customer choices [34]. Attitudes toward food delivery Apps, reflecting degrees of trust on food delivery e-commerce sites by deliverers, restaurants, and customers, depend on perceived value determined by convenience, design, trustworthiness, price, food choice variety, and household's situations [35, 36]. Restaurants face two opposing motivating factors simultaneously: 1) factors in favor of outsourcing food delivery to third-party online service providers: increasing revenue, increasing exposure, connection with more customers, convenience, and location consideration; 2) factors against outsourcing online delivery service: food related issues, strategic concerns of locations, customer affordability, cost, and little control [37].

Nevertheless, platform economy is disrupting existing employment relationships. The job quality of food

delivery platform industry, consisting of economic, enjoyment, and autonomy factors, is poor as seen in the cases of Deliveroo, Uber Eats, and China's delivery industry [10, 30, 38, 39]. 'Delivery rider' is an emerging occupation resulting from the booming of online commerce. However, issues such as high rate of road accidents in China due to the prevalence of unsafe riding, and poor working conditions of delivery riders in Korea have raised social controversies [27]. Deliverers of Belgian Deliveroo have fewer working hours and less income when transferred from company-employed toward self-employed [40]. Therefore, O2O channels can serve as a complement to, rather than a substitute for, the offline channel in the restaurant industry [41, 42]. With the O2O business model promoting more offline business and companies attracting more users, users can also increase the O2O business model in return [41, 42].

Sales will not immediately decline if customers use several platforms, known as multi-homing, because platforms do not sell products or services directly. However, multi-homing weakens the network effect, especially the fully monetizing cross-side (indirect) network effect [10]. Therefore, reducing multi-homing is an important goal for all platform companies, such as Apple versus Adobe Flash, Alibaba versus Baidu, and Deliveroo versus Uber Eats who are UK competitors facing multi-homing [19]. At any point, the likelihood of a winner-take-all in platform business will depend on the difficulties of multi-homing, whereby with modern transaction platforms, tangible costs of multi-homing are trivial [10]. For WhatsApp, the network effect of non-multi-homing platforms, known as demand-side economics of scale, is destructive; however, it was quite compelling that in 2014, Facebook acquired the company for 22 billion USD [43]. Amazon Flywheel or subscription models like Adobe or Apple music are traditional examples of expanded network effects without multi-homing [44, 45].

Open innovation, as the antithesis of the traditional vertical integration model, unlike the new 'in-sourcing' model of Tesla, is a distributed innovation process based on purposively managed knowledge flows across organizational boundaries. Using pecuniary and non-pecuniary mechanisms in line with the organization's business model and designing and managing innovation communities including O2O platforms will become increasingly important for the future of open innovation [4].

Food delivery platform industry is accelerating worldwide but through very different approaches. China's first online food reservation company, Ele.me, was founded in 2009, much later than Open Table, the US largest online reservation platform established in 1998. However, China's food reservation platforms are growing explosively with high consumer demand, intensive competition of capital market investment in the online booking platform, and diversified market development [46]. Deliveroo, the UK restaurant online marketplace launched in London in 2013, provides an average of 32 minutes fast delivery of local restaurant-cooked food in over 200 cities across three continents, avoiding the fierce competition model as found in the US [10]. Even though South Korea has long history of food delivery service, like China its delivery platform industries did not grow up until 2020.

1.2. Research Question

Since the emergence of the fourth industrial revolution, the smart delivery industry is relying heavily on smartphone application (App) platforms in most capitalist countries. The restaurant industry is a representative service sector where open innovation is explosively increasing with smart delivery platforms and Apps [47-49]. Thus, the smart delivery industry will motivate new emergence and complexity for open innovation dynamics [50]. The smart delivery industry is demonstrating significant effects in the food sector and in diverse manufacturing sectors, such as drone and service industries [51]. Soon, the impact of the smart delivery industry will affect nearly all industries. This study aims to answer the following research question.

What is the difference in the open innovation and multi-homing of the smart delivery industry among Cardiff, Daegu, and Nanjing according to the maturity of restaurant industry of the capitalist economies they belong to?

We want to resolve the research gap between 'the existing two-sided platform theory based on network theory', and 'the three-sided (deliverer, customer, restaurant) aspects of delivery platform industry with the co-existing of network effect and gig economy phenomena' from this research question. By comparing open innovation and multi-homing of delivery platforms of the three cities, we will find out the reality and theoretical points of three-sided delivery platforms, the merits and deficiencies based on the similarities and differences of the three economies. The research is significant in terms of finding the way to the sustainable growth of the delivery platform industry, conquering the negative effects of gig economy.

In the 21st century, as the fourth industrial revolution shows varying effects on capitalist economies, according to maturity levels of restaurant industry of capitalist economy, we want to explore the difference of open innovation (including business model, and multi-homing of the smart delivery industry between a mature capitalist country in restaurant industry (United Kingdom), a late capitalized country from 1945 (South Korea), and a transforming national monopoly capitalist country from 1978 (China).

2. Research Scope, Framework, and Method

2.1. Research Scope

Our research team selected three targeted places for investigation, namely locations near the University of South Wales, Cardiff, Wales, near Daegu Gyeongbuk Institute of Science and Technology (DGIST) in Daegu of South Korea, and near Nanjing university of Science and Technology, Nanjing, China. Details of the locations and research scope are summarized in Table 1. Cardiff, Daegu, and Nanjing were selected for the reasons that: 1) Cardiff represents mature capitalist economy () from 18th and 19th century which has well-developed restaurant industry, 2) Daegu indicates partially-developed capitalist economy from 1945 with partially-developed restaurant industry, and 3) Nanjing represents developing capitalist economy from 1978 with under-developed restaurant industry. Three universities, University of South Wales, DGIST, and Nanjing university of Science, and Technology were selected as similar research settings across the three countries.

Table 1. Research method, and research scope

Locations	Three sides of platform	Research methods	Research Scope
Cardiff	Deliverer	Interview	20 deliverers on Queen Street near University of South Wales in the city center of Cardiff, 10 th , 11 th , 13 th Dec, 2019, and 8 th , 16 th , 20 th , 22 nd Jan 2020
		Participatory observation	Near Pret A Manager Cardiff, Capital Centre, Shop No. 333, 10am-1pm 10 th Dec 2019 Burger King, 78 Queen Street, Cardiff, 10am-1pm 11 th Dec 2019 KFC, Queen Street, Cardiff, 10am-1pm 12 th Dec 2019
	Restaurant	Interview	15 Restaurants in Queen street and nearby, within 1-3 km of University of South Wales Cardiff campus, 9 th , 10 th , 11 th , 12 th , 13 th Dec, and 8 th , 20 th Jan 2020
		Participatory observation	Queen Street and nearby within 1-3 km of University of South Wales Cardiff campus, 12 th Dec 2019
	Customer	Interview (Questionnaire based)	29 Students from the University of South Wales about usage of delivery platform in UK, 22 nd , 27 th Nov 2019
	Daegu	Deliverer	Interview
Participatory observation			Near the DGIST No.1 gate, E-mart convenience store, 10am-1pm 8 th Oct 2019 100m outside DGIST No.1 gate, A-Two-Some-Place café, 10am-1pm 10 th Oct 2019 100m outside DGIST No.1 gate, A-Two-Some-Place café, 10am-1pm 14 th Oct 2019
			20 Restaurants mostly near DGIST and 2-3 at Daegu city center, 7 th , 8 th , 10 th , 11 th , 14 th -18 th Oct 2019
Restaurant		Interview	20 Restaurants mostly near DGIST and 2-3 at Daegu city center, 7 th , 8 th , 10 th , 11 th , 14 th -18 th Oct 2019
		Participatory observation	Techno-JungAng-Street and nearby within 1-3 km of DGIST, 15 th Oct 2019
Customer		Interview (Questionnaire based)	43 Students from DGIST about usage of delivery platform in South Korea, 7 th Sep 2019
Nanjing	Deliverer	Interview	22 deliverers within 1-3 km of Nanjing University of Science and Technology, 20 th - 24 th Sep 2019
		Participatory observation	Near Café Teimuan, outside Nanjing University of Science and Technology, 10am-1pm 20 th Sep 2019 Outside Nanjing University of Science and Technology, 10am-1pm 21 st Sep 2019 Outside Nanjing Science and Technology University No.1 gate, 10am-1pm 22 nd Sep 2019
			15 Restaurants within 1-3 km of Nanjing University of Science and Technology on 20 th -24 th Sep 2019
	Restaurant	Interview	15 Restaurants within 1-3 km of Nanjing University of Science and Technology on 20 th -24 th Sep 2019
		Participatory observation	Kun Yim commerce street, near Nanjing University of Science and Technology No.3 gate, 24 th Sep 2019
	Customer	Interview (Questionnaire based)	40 Students from Nanjing University of Science and Technology about usage of delivery platform, 23 rd Sep 2019

2.2. Research Framework

Normally, a platform ecosystem consists of two-sided actors such as producers who creating products for the platform and consumers who purchase or use the products [24]. Platforms include providers of the platform interface and owners who control the platform [24].

However, delivery platform industry shows three sides, namely deliverer, restaurant, and customer. In addition, main components of delivery platforms are information and knowledge which are produced by deliverer, restaurant, and customer by the interaction with the delivery platform. Hence, open innovation between deliverer and delivery platform, between customer and delivery platform, and between restaurant and delivery platform are the main focus of this research as illustrated in Figure 1.

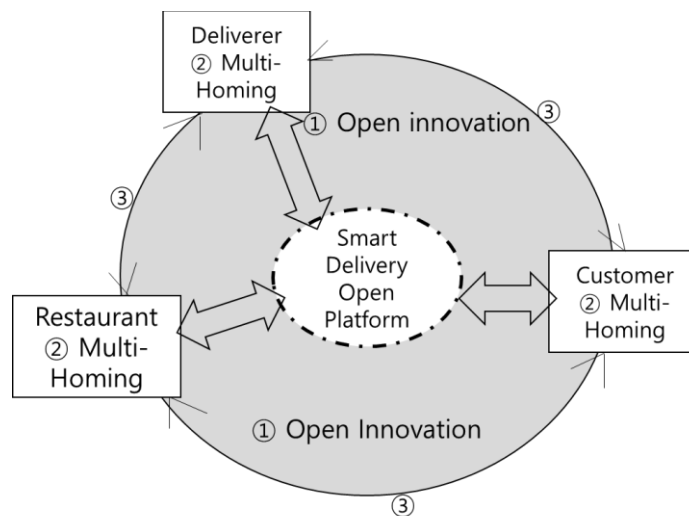


Figure 1. Structure and Actors of a Smart Delivery Open Innovation Platform

First, we analyze three open innovations among smart delivery platforms and compare the differences of the economies. The smart delivery industry is evolving based on open innovation platforms with three main agents, shown in Figure 1: deliverer, customer, and restaurant [11]. In contrast to transaction platforms, innovation platforms enable “open innovation” in a variety of settings; Cusumano et al. (2019) argue that, “*this is an effective way for companies to enhance the value of their products and services with relatively small in-house investments, compared to the potential benefits from thousands or even millions of third-party innovations*” [10]. Consumer-driven food and beverage open innovation which designs products to meet consumer needs, can be achieved through an open innovation friendly company culture or usage of food delivery platforms [52, 53].

Second, in this study we compare the difference of multi-homing of all delivery platform players, namely restaurants, deliverers, and customers among the three economies (Figure 1). Multi-homing of the delivery platform occurs alongside the open innovation expansion, because multi-homing means utilizing of multiple platform which motivate the expansion of interaction among agencies [54]. Actors in delivery platform such as deliverer, customer and restaurant use a multi-homing strategy when choice diversity, incentives, and other benefits from the platforms are greater than the cost. By measuring multi-homing from several aspects of delivery platforms of the three economies, we can understand the differences in the smart delivery platforms.

Third, we analyze the interaction of the three elements (restaurant, customer, and deliverer) by comparing the interactions in the three economies. The level and content of the interactions will affect multi-homing and usage of delivery platforms.

From these steps, we will answer the research question and generate new business models that can increase the sustainability of the smart delivery industry within a capitalist economy.

2.3. Research Method

The research team mainly used interview method with semi structured questionnaire for deliverers, restaurant

chiefs or managers, and university students as customers who are related to the delivery platform industry, as shown in Table 1, and Appendix. In addition, the team used participatory observation method for deliverers and restaurants 1 (see Table 1) to explore additional statistics which can be used to compare the three cities. Interview method with semi-structured questionnaire and participatory observation is useful to reflectively compare delivery platform industry of the three cities motivated by different economic conditions.

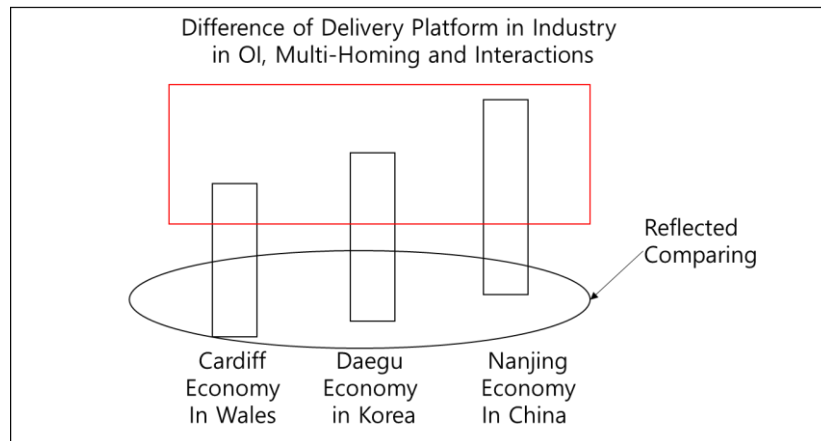


Figure 2. Reflected Comparing among Economies

The 2019 Nobel prize in economics was awarded for randomized control trials (RCT) to determine well-operated poverty policy [55]. In addition to research on poverty policy, a diverse set of social experiments, including health insurance, prisoner rehabilitation, labor supply, worker training, and housing subsidies, have used randomized field trials [56, 57]. There are several deficiencies of RCT, including improper allocation of overhead costs, ethical issues of experimentation with human beings, limited duration of social experiments [58, 59]. From RCT, we developed reflective comparison among economies (RCE), which concerns and compares targeted social groups (Figure 2). RCE agrees that the comparative research groups are different from the beginning and cannot be randomized. Additionally, it does not compare policy results but compares impact results of different capitalist economic situations by establishing reflective and highly meaningful groups. By comparing business models of delivery platform or open innovations of the three actors (deliverer, restaurant, customer) among the three economies (Wales, South Korea, China) through qualitative research methods such as interview and participatory observation, researchers will have more chances to detect grounded theory which decide the evolution of delivery platform industry [60]. RCE is useful as a qualitative research method that includes interviews using a semi-structured questionnaire based on the laddering interview technique, and descriptive statistical analyses [61, 62]. Through the combination of qualitative analyses and descriptive statistics, we compare the reflective effects of different capitalist economies based on the diversity of open innovation and business models in smart delivery industry.

3. Smart Delivery in Three Economies

3.1 Smart Delivery Industry at Cardiff in the Wales

According to interviews with restaurants, deliverers, and customers at Cardiff in Wales, there are several popular smart delivery platforms, including Deliveroo, Uber Eats, Just Eat, Hungry Panda, and Stuart, as well as individual platforms such as Domino's Pizza. Deliveroo is the most used platform in the United Kingdom. Customers can give an evaluation grade from one to five stars. Both delivery and pick-up are possible, and restaurants can set the delivery time after receiving a customer order. Customers can order food for same-day delivery or the following day, and they can see restaurant locations from Google maps or Apple maps. Customers who order alcohol must show ID proving their age when receiving the food.

According to the semi-structured questionnaire about delivery platform usage, Cardiff restaurants communicate with platforms, providing and accepting ideas with medium level open innovation with regards to menus, services, and new systems, which are based on the multi-homing of other delivery platforms according to the interviews (see Figure 3).

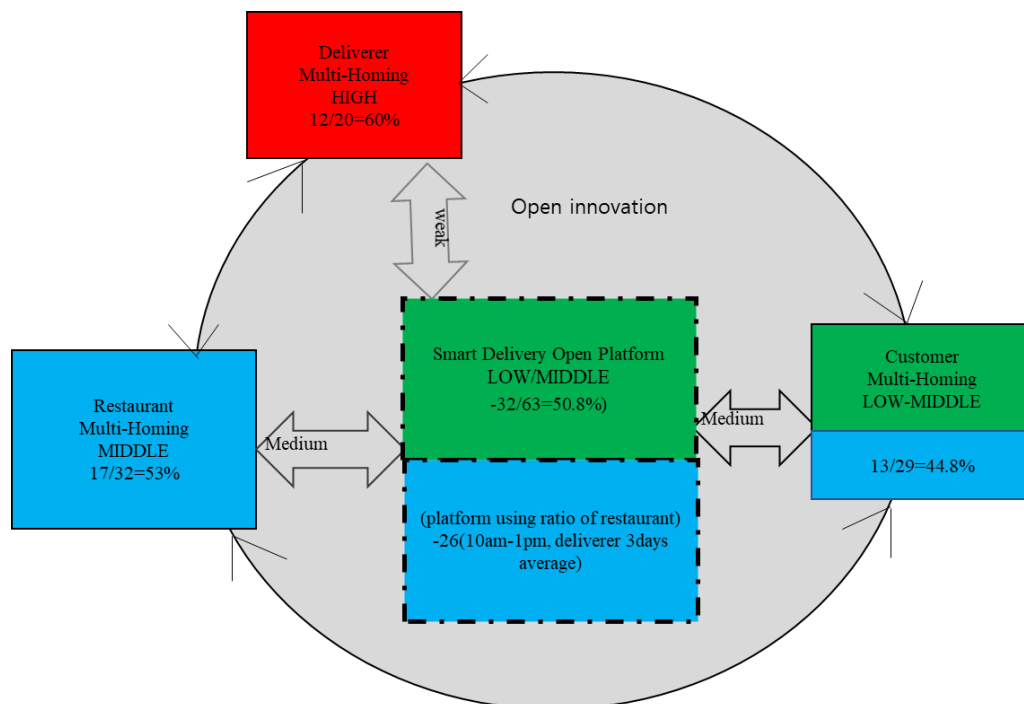


Figure 3. Smart delivery open innovation platform of United Kingdom

Accordingly, UK restaurants with a long history and unique culture do not utilize smart delivery platforms so much as ‘emergent’ newcomers according to the usage ratio of delivery platform by restaurant is just 50.8%. This reveals that well-developed restaurants do not seek to use ‘gig’ innovation business models, such as smart delivery platforms. Of the 15 restaurants interviewed, 11 belonged to big restaurant chains with a minimum history of 10 years.

Among UK restaurants utilizing smart delivery platforms, only 53% used several platforms (multi-homing). The multi-homing ratio of UK restaurants is low compared to China, but it is similar to Korea. However, according to the interviews, multi-homing of restaurants is increasing, in order to sell food and increase advertising. As almost all delivery Apps show restaurant locations, several restaurants agree to increase offline and online selling together.

In addition, platforms receiving fees paid as a proportion of the food-selling price varied 10-50%, according to the negotiation power of chain restaurant headquarters and requirements from delivery platforms.

Deliverers in the United Kingdom have a high ratio of multi-homing. Among the 20 deliverers interviewed, 12 were multi-homing, as there were not enough orders from a single platform. There is no penalty if they reject the delivery order, which is a primary concern for deliverers choosing multi-homing (Figure 3). Based on the interview, some deliverers moved from multi-homing to using just one platform. Evidence shows that deliverers are changing from multi-homing to single platform use in the United Kingdom. Three deliverers claimed to cease multi-homing because they were earning enough from one platform.

Through participatory observation, 26 deliverers were active between 10am-1pm on an average of three days. The small number of delivers does not motivate enough communication with platform which is a kind of open innovation. Though there are systems for deliverers to communicate with platforms through Apps and email, Cardiff deliverers do not use them frequently. In addition, more than 50% deliverers interviewed admitted that they had another job besides deliverer, which prevent them from enhancing open innovation with platform. But, as a type of gig economy, deliverers in the United Kingdom have a unique situation. Deliveroo covers deliverers’ basic insurance, and most platforms (except for Uber Eats) give deliverers the freedom to reject a delivery order without a penalty. Deliverers receive call allocations from platforms and see the destination before accepting the order call.

. Customer participants for the interview about delivery platform usage included junior undergraduate students and first year master students from University of South Wales, Cardiff. Among the 32 students, three were non-users, and 44.8% were multi-homing users. The customer multi-homing ratio of the United Kingdom is higher than China and similar to Korea, regardless. Most UK customers said that their usage of delivery

platforms increased by 10-100% over the previous year.

Customers actively provide feedback on deliverers and restaurants through platforms, representing a medium level of open innovation. They enjoy communicating with other customers through platforms about locations and delivery conditions. Though customers can rate and comment on deliverers and restaurants, restaurants can also write opinions about customer behaviors and prohibit customers from commenting on the platform.

3.3 Smart Delivery Industry at Daegu in South Korea

In Korea, there are two main delivery platforms, Bemini and Yogiyo, and several smaller delivery platforms. In addition to smart delivery platforms, there are several deliverer brokerage firms that employ deliverers and use the platforms. Currently there are two types of smart delivery platforms in Korea like Figure 4.

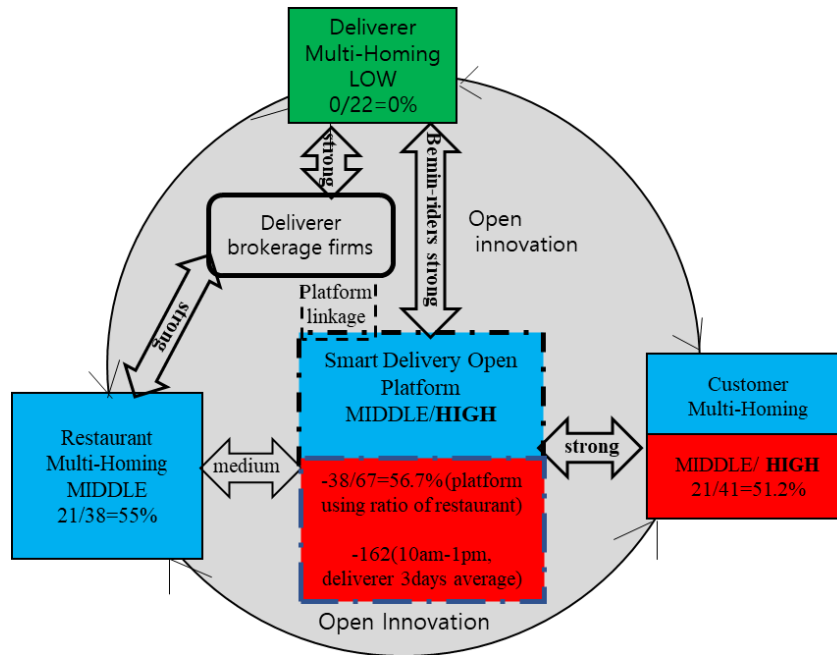


Figure 4. Smart delivery open innovation platform of Korea

First, most smart delivery platforms work with brokerage firms that provide deliverers and use the platforms. The main smart delivery platforms are Bemini, Yogiyo, and Bedaltong, and brokerage firms include Vroong, SengGagDeRo, Technk-Quick, and JES-Quick. Deliverers use the brokerage firms' platforms, including SengGagDeRo, Vroong, Moa-call, Barobon, and Win-win. In this system, if a customer pays the delivery fee (3.3 USD), it is shared by the deliverer (2.7 USD), brokerage firm (0.4 USD), and platform (0.2 USD). Apart from this, brokerage firms receive a delivery responsibility fee (66 USD) monthly from restaurants. Each delivery brokerage firm has approximately 50-200 contracted restaurants, and a restaurant works mainly with one contracted delivery brokerage firm.

Second, the Bemini-rider delivery platform, a minority smart delivery system unique to Korea, does not collaborate with brokerage firms. Customers order from the Bemini smart delivery platform, and Bemini-riders follow the delivery requirements from the restaurants. After delivery confirmation, Bemini-riders deliver food and receive the delivery fee from customers or restaurants according to the distance.

Korea restaurants perform a medium level of open innovation by engaging with platforms in terms of food image, new menu, or high competitiveness, even though there is intersection among the brokerage delivery firms.

Based on the interviews about delivery platform usage, approximately 56.7% of restaurants in Korea use a smart delivery platform, which is higher than the United Kingdom and lower than China (Figure 5). Korean restaurants have a long tradition of food delivery, making restaurants accustomed to brokerage firm-based food delivery platforms, which gives restaurants confirmation of food deliveries to customers.

More than 90% of restaurants that previously offered delivery started using a smart delivery system. More than half of the Korean restaurants in our study paid all delivery fees if the food order amount was large enough, otherwise only 30-50% of the delivery fee if it was a small order.

Among Korean restaurants that use smart delivery platforms, 55% of restaurants used multiple platforms (multi-homing). The multi-homing ratio of Korean restaurants is high compared to China but is similar to the United Kingdom (Figure 4). However, restaurants mainly multi-home with Bemin and other platforms to receive promotion incentives from the platforms, or to follow headquarters' requirement of using certain delivery platforms. There are two types of platform fees paid by Korean restaurants: 1) the Bemin type is a monthly fixed payment (88 USD) + 3.3% ratio of food selling price that includes card usage fee; 2) the Yogigo type is paying 16-18% of the food selling price, which is adopted by almost restaurants consistently.

Restaurants interact with platforms to a medium degree regarding food, delivery conditions, new menu advertisement, or restaurant conditions. The evaluations and comments from customers make it more difficult for small and new restaurants to respond to platforms.

Deliverers in Korea lock in only one deliverer platform or smart delivery platform (Figure 4). Among the 22 deliverers interviewed, 18 belonged to brokerage firms, using only one deliverer platform. Four Bemin-rider deliverers used only the Bemin platform. The brokerage firms' existing network with 50-200 delivery-contracted restaurants resulted in no deliverer multi-homing. As brokerage firms manage almost all food delivery calls from restaurants in a zone, deliverer candidates normally have no choice but to apply for the brokerage firms' deliverer jobs, even though a large proportion of the delivery fee should be shared with the brokerage firms and deliverer platform firms. Deliverer's average salary is between 2,700 USD and, 3,300 USD, per month without receiving insurance from brokerage firms. Only Bemin covers the insurance fee for Bemin-riders. Nevertheless, Bemin receives a small proportion of the delivery fee from riders, along with fees for motorcycle, helmet, delivery uniform, and rental.

Daegu deliverers communicate for high level open innovation with brokerage platforms based on working time, working pattern, and delivery course etc. This is because they are locked-in one platform like full time jobs , and there are even office for deliverers from the brokerage firms. Deliverers have strong communications with brokerage firms to receive new calls through platforms and to communicate indirectly with restaurants and customers via calls or meetings. Bemin-riders communicate with the platform directly to accept new calls and to connect with restaurants and customers through Apps. Compared to China, most Korean deliverers do not communicate with customers or restaurants frequently indirectly through the platforms. This is due to the lack of a good rating system for customers and restaurants regarding the platforms' deliverers, which affects delivery fees for the deliverers.

The number of deliverers active on average for three days each week between 10 am-1 pm was 162. This active deliverer number is high compared to the United Kingdom (29) but small compared to China (223). Korea's smart delivery platform has more growth potential. Nearly 70-90% of deliverers interviewed claimed food delivery as their full-time job; they work nearly 12 hours per day 6 days per week on average. The working condition of deliverers in Korea is tougher than in China and the United Kingdom.

Customer participants for the survey about delivery platform usage included 43 freshmen and sophomore students at the undergraduate school of DGIST. Among them, 41 were using delivery platform Apps, and 21 (51.2%) were multi-homing users. The customer multi-homing ratio of Korea is higher than China (22.1%) and the United Kingdom (44.8%). According to the survey, Korean customers' multi-homing ratio is decreasing, even though the usage of delivery platforms is increasing. In Korea, high-speed transmission Wi-Fi has a positive impact on displaying a diversity of restaurants' photos on delivery platforms. This motivates more customer' use of delivery platforms. However, Korean platform customers are becoming lock-in platform users.

Customers actively communicate through platforms to receive information about restaurants and give feedback to restaurants about food and deliverers (Figure 4), regarded as a high level open innovation. They frequently read evaluation results about food and restaurants in the high-speed mobile internet environment of Korea. Customers of a smart delivery platform will voluntarily and diligently express opinions on restaurants and foods consumed. Korea's high-speed mobile internet infrastructure and strong, long-term experience of social networking services (SNS) cultivate these customer habits.

3.3 Smart Delivery Industry at Nanjing in China

Through interviews with restaurant managers, deliverers, and customers, two platforms, Ele.me and Meituan, have the biggest market share, and small platforms, such as DiDi, DaJungPeung, and JD.com (Appendix). Meituan and Ele.me have three similar delivery fee methods. For Meituan, the delivery fee methods are: 1) delivery-grade based delivery fee method, 2) team-based fixed delivery fee method, and 3) distance-based delivery fee method. Meanwhile, there are two standards of Meituan's delivery-grade based delivery fee methods inside and outside the city center.

According to the results of questions on delivery platform, 95.2% of China's restaurants use a smart delivery platform, which is high compared to the United Kingdom and Korea (Figure 5). According to interviews, there are not enough restaurants in China to meet the requirement of all the population. The huge number of customers uses the take-out-oriented restaurants, which include 19 of 62 restaurants from our observation and 9 of 15 restaurants from the interview. According to the interview, these restaurants in China easily transformed into smart delivery platform-based businesses.

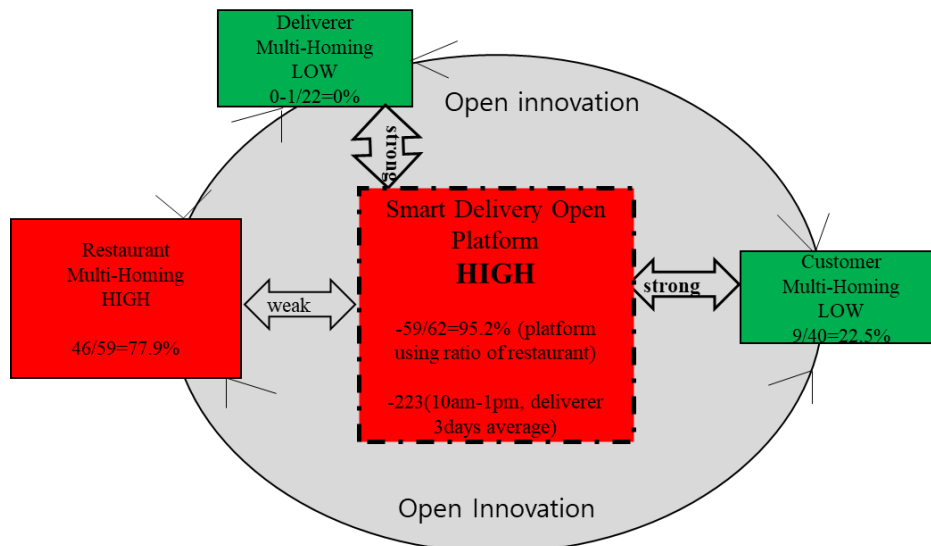


Figure 5. Smart delivery open innovation platform of China

Nanjing restaurants interact with platforms weekly about food, delivery conditions and other issues, seen as low level of open innovation, but not about the co-promotion of restaurants and platforms.

Among China's restaurants using smart delivery platforms, 77.9% used multiple platforms (multi-homing). The multi-homing ratio of China restaurants is high compared to the United Kingdom but similar to Korea (Figure 5). However, the multi-homing of restaurants is for advertisement effects as well as for selling food, and this increases take-out selling, according to more than seven restaurants interviewed. The fee to use the platform is a proportion of food price, which is similar among restaurants due to the high level of multi-homing.

Deliverers in China show nearly zero multi-homing. Among 22 deliverers interviewed, one did not answer clearly, and 21 used only one delivery platform, either Ele.me or Meituan, because there are enough orders from one platform. Meanwhile, there are incentives for acquiring enough call delivery, and deliverers will face diverse penalties for rejecting calls from all platforms (Figure 5). In addition, several deliverers said they would not move to another platform if they are accustomed to one system, as the systems have different processes.

With 223 deliverers active between 10 am-1 pm an average of three days per week, this is significant compared to 29 in the United Kingdom and 162 in Korea. This demonstrates high growth of China's smart delivery platform. Nearly 100% of deliverers interviewed had food delivery as a full-time job in contrast to the UK deliverers.

Nanjing deliverers who are locked in one platform as full-time job try to communicate with platform, known as high open innovation, about the working condition, delivery situation etc. There are systems for deliverers to communicate with platforms through Apps and email, which they frequently do to apply the same direction calls, announce sustaining time limits, or maintain diverse requirements from platforms. Their communication with customers and restaurants is more frequent and direct than indirect communication through platforms, because customers' and restaurants' good evaluations of deliverers can affect the delivery fees.

As a representative gig economy, the situation of deliverers in China has a special meaning; most deliverers of Ele.me and Meituan work full-time, earning 1,050-1,350 USD every month, which is almost twice the monthly salary of a recent university graduate. Nevertheless, deliverers in China pay 0.15-0.75 USD damage insurance every day. Apart from a distance-based delivery fee method, deliverers cannot reject calls assigned from the platforms. There are penalties for deliverers for reasons including not keeping delivery time limit, call rejection, or bad evaluation from customers.

Customers actively communicate with and provide feedback for restaurants through platforms, regarded as a high level of open innovation. They choose food based on a restaurant's grade evaluated by other customers and

the promotion information of restaurants on the platforms (Figure 5). Customers enjoy communicating with deliverers through platforms about locations and delivery conditions. In addition, customers interact with restaurants regarding food rating and services.

Customer participants for the interview about delivery platform usage included 40 sophomore students from the radio and television department of Nanjing University of Science and Technology, China. All were using delivery platform Apps, and 22.5% were multi-homing users. The customer multi-homing ratio of China is low compared to the United Kingdom (44.8%) and Korea (51.2%). According to the interview, discount promotions, coupons, and being accustomed to specific platforms reduce multi-homing. The ratio of multi-homing customers increased 20% over the last year, which is opposite to the case of the United Kingdom.

3.4. Comparing Three Economies in the Smart Delivery Industry

In deliverer open innovation, on average Nanjing which has 223 deliverers, Daegu which has 162 deliverers based on the participatory observation (three hours each day, across three days). These indicate high level open innovation in terms of high communication with platforms like Table 2. However, Cardiff which has just 26 deliverers based on the same participatory observation method, demonstrating low level open innovation in a sense that most deliverers have another job, and they do not try to communicate with platforms.

Table 2. Comparing the open innovation and multi-homing of delivery platform in three cities

Economies	Deliverer Open Innovation (OI) Multi-Homing Interaction and etc.	Restaurant Open Innovation (OI) Multi-Homing Interaction and etc.	Customer Open Innovation (OI) Multi-Homing Interaction and etc.
Cardiff, Wales	Weak OI platform High multi-homing =60% 3days-3hours average numbers of delivers = 26	Medium OI platform Middle multi-homing =53% Restaurant ratio of delivery platform usage = 50.8%	Medium OI platform Low-middle multi-homing =48.8%
Daegu, Korea	Strong OI platform Low multi-homing=0% 3 days-3 hours average numbers of delivers=162	Medium OI platform Middle multi-homing=55% Restaurant ratio of delivery platform usage =56.7%	Strong OI platform Middle-high multi-homing =51.2%
Nanjing, China	Strong OI platform Low multi-homing=nearly 0% 3 days -3hours average numbers of delivers=223	Weak OI platform High multi-homing=77.9% Restaurant ratio of delivery platform usage =99.2%	Strong OI platform Low multi-homing =22.5%

Second, in restaurant open innovation, even though Nanjing has the restaurant ratio of usage delivery platform of 99.2%, restaurants in Nanjing show weak open innovation with platforms, because delivery platforms expand too broadly without concerning high value based on the platform communication according to interviews. But they chose multi-homing of platforms as reacting strategies.

Third, in customer open innovation, Daegu customers perform strong open innovation with platforms, featured with middle-high multi-homing. This means the active developing of delivery platform based on communication with customers can be a future trend for Daegu and South Korea.

Fourth, in Cardiff, the high multi-homing and low open innovation from deliverer perspective show the early stage of smart delivery platform industry. With the increase of open innovation with customers with sufficient multi-homing, the diverse development of delivery platform business model can be possible.

4. Finding grounded theories

4.1. Existing industries in capitalist economies can disturb the growth of delivery platform industry

The results indicate that the situation of the smart delivery industry differs according to the economy.

First, The negative growth trend the UK delivery industry results from its existing economic conditions, including the long history of well-developed restaurant industry with active social relationships and traditions. This finding is consistent from interviewing the restaurant owners, and participatory observation of various tradition restaurants in Cardiff city center which do not use delivery platforms. There is well-established protection of labor rights according to several deliverers, allowing them stopping delivery any day any time without penalty, which is opposite to the situation of Nanjing or Daegu. In other words, existing traditional restaurant industry hinders the growth of smart delivery industry in UK. The United Kingdom's long history of a capitalist economy, does not provide mature conditions for the smart delivery industry, even though UK delivery platform firms, such as Deliveroo and Just Eat, were established earlier than Meituan or Ele.me in China and Bemini or Yogiyo in Korea. The rudimentary condition of the UK delivery platform industry demonstrates the following flaws, 1) not enough calls from restaurants; 2) no full-time deliverers but part-time deliverer systems; 3) few deliverers; and 4) the popularity of delivery choice is highest among chain restaurants and cafés.

Second, in China, the smart delivery platform industry is increasing rapidly. Nanjing does not have a matured capitalist restaurant industry in the industrial revolution paradigm. The large population, the fast growth of China's economy in addition to the insufficiency of an existing traditional restaurant industry promote the rapid rise of delivery platform industry, and the appearance of pick-up restaurants and cafes. Even though the income of deliverers in Nanjing is comparatively higher than Cardiff and Daegu, the rights of deliverers are not protected by platform firms. Deliverers in China can only choose from three call-receiving methods: 1) call allocation with small chances of rejection; 2) call application with unlimited rejection with possibility for long distance delivery; and 3) team-based high revenue with high control deliverer system.

Third, in Korea, the existing traditional delivery brokerage firms intercept revenue from deliverers and restaurants without enough contribution and without control from the Korean government. In other words, existing traditional delivery brokerage firms are disturbing the growth of smart delivery industry by intercepting the revenue of deliverer and restaurants. Meanwhile, the delivery brokerage firms are not controlled by the Korean government which is opposite to the situation of Wales where agents cannot control the labor condition of workers without the permission of law and government according to deliverers' comments. In addition, delivery platform firms are under development due to lack of integrated software (S/W) for customers, deliverers, and restaurants. They also intercept delivery fees of deliverers in several ways. In Korea, the rights of workers are not protected enough compared to Cardiff. Despite the long history of food delivery in Korea restaurants, there is just a middle level growth of the delivery industry.

4.2. Multi-homing motivates high labor state of deliverers, the acceptance of restaurants by customers, and customer surplus

Smart delivery industry is a new distribution industry that meets the IOT and mobile internet in the fourth industrial revolution. Furthermore, smart Delivery industry is a three-sided platform industry whose growth depend not on labor or capital, but on open innovation, meaning adequate knowledge or information-based communication with the platform. In this situation, new rules to distribute the platform revenue fairly, and to protect deliverers and restaurants from platforms should be developed including platform tax, and social functions of platform firms.

As for the situation of Cardiff in Wales, high multi-homing motivates high labor state of UK deliverers such as allocation based on calls (platform cannot control deliverer highly), no penalty for deliverer's call rejection by platforms.

In competition among platforms, restaurants in high multi-homing will not be controlled by platforms easily. In other words, multi-homing of restaurants increases the acceptance of contract condition between restaurants and platforms.

High multi-homing of customers can increase the customer surplus such as the diversity of choice, freedom to reject platform policy, or reduce the cost of the platform. Moreover, high multi-homing of customers is maintained while the scale of platform industry and firms is not large enough.

4.3. Motivating Open Innovation in Delivery Platforms can maintain high the multi-homing level of it after maturity stage

According to this research, taking the Cardiff for example, high multi-homing of the three agents can increase the welfare of deliverers, restaurants, and customer respectively. Nevertheless, with the maturity of smart delivery platform, the multi-homing of the three agents can be decrease as shown on the left side (b) of Figure 6.

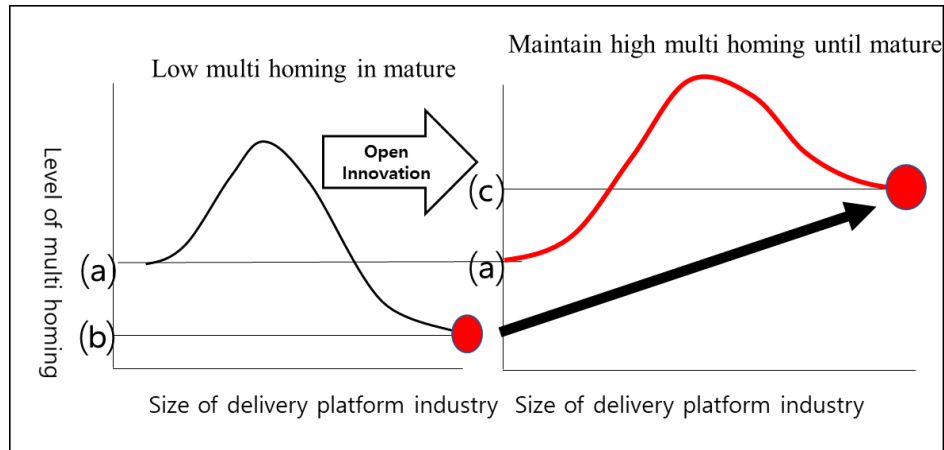


Figure 6. The way to maintain the multi-homing level high before the maturity of delivery platform industry

However, if it is possible to highly motivate the open innovation of the three agencies before the maturity of smart delivery platform industry, like the customer open innovation in Nanjing, or deliverer open innovation in Daegu, the multi-homing of matured smart delivery platform can maintain at a high degree, as shown in on the right side (c) of Figure 6.

According to our qualitative field research, the best way of sustainable smart delivery platform industry is to motivate of open innovation of 3 agents and increase the multi-homing level of the industry at the matured stage.

5. Conclusion

5.1. Main Findings

First, this study found that different economic conditions give effects to the smart delivery platform industry. An existing well-developed traditional restaurant industry disturbs the growth of the smart delivery industry, like at Cardiff in Wales. Meanwhile, existing well-developed delivery brokerage firms hinder the development of the smart delivery platform industry, like at Daegu in Korea. In China, economy growth and the emergence of new take-away oriented restaurants motivate the smart delivery platform industry according to interviews with deliverers and restaurants in Nanjing.

Second, high multi-homing of deliverers accompanies the increase of labor condition of deliverers, even though it comes with low growth of the delivery platform industry as seen in the case of Cardiff. High multi-homing of restaurants can motivate high growth of the delivery platform industry as shown in Nanjing, even though it triggers high competitions among delivery platforms. Besides, the multi-homing of customers can increase the customer surplus in delivery platforms according to Daegu, even though it can decrease the growth of platform industry.

Third, high multi-homing without enough open innovation in smart delivery platform industry cannot be maintained according to the interviews with deliverers, customers, and restaurants in Cardiff, Daegu, and Nanjing. This is because active open innovations can only introduce new business models continuously in the delivery platforms, which can endure the burdens from multi-homing.

5.2. Implication

The theoretical implication is that on the multi-sided platforms, when open innovation is motivated in addition to multi-homing, platform industries triggered by digital transformation can grow with the increase of welfare or surplus of component agents, not just with the platform itself. There are many negative evaluations such as the digital cage, accelerants of precarity, institutional chameleons, permissive potentates about the platform-based gig economy which is defined as “people using Apps (also commonly known as platforms) to sell their labor [63, 64]”. This study theoretically proposes the way to conquer the negative effects of the platform industry. If any platform can maintain the multi-homing at a high level the platform is mature, the platform can reduce the negative effects of platform industry to a level acceptable to the multi-sided agents.

In practice, industries have great impact on the growth of the smart delivery platform industry. The existing and long-standing restaurant industry cannot match the existing delivery platform industries. If the delivery platform can include new reservation systems etc., for restaurants with a long history, reconciliation between delivery platform firms and these traditional restaurants will become possible. Delivery brokerage firms are

intercepting in the relations between platforms and deliverers, or between platforms and restaurants. There is a requirement for social contracts which define the delivery brokerage firms, and systems developed on the platforms which define the role of the brokerage firms. Take-away only restaurant or cafe industry can grow fast with the support of the delivery platform industry. Nevertheless, new social contracts or technological system can check the food hygiene and the cleanness of the places.

5.3. Limitation of this study and future research targets

First, this study focused on the multi-homing and open innovation of deliverer, customer, and restaurant. Thus, we did not analyze platform structure, function, or software. As one of the next research goals, analysis on structure, function, interaction, networking, and software itself of the smart delivery platform is needed.

Second, although we found 3 grounded theories such as 1) Existing industries in capitalist economy can disturb the growth of delivery platform industry; 2) Multi-homing motivates high labor state of delivers, the acceptance of restaurants by customers, and customer surplus, and; 3) Motivating open innovation in delivery platforms can maintain high degree of multi-homing after the industry maturity stage. However, our research scope has not considered: 1) the relation between existing industries and delivery platform industries in different economies, 2) the dynamic change of the multi-homing effects on delivery platform industry alongside the lifecycle of firms and industries, and 3) the dynamic relation change between open innovation and multi-homing in delivery platform industry with the growth of the platform industry. They can be the future research areas.

Third, this research is mainly based on qualitative methods such as interviews and participatory observation. In future research, open innovation of customers, deliverers, and restaurants in the delivery platform industries can be analyzed with quantitative research methods to examine the relations between multi-homing and open innovation. Quantitative data of open innovation can be obtained from the database of delivery platform firms. Statistical information of the multi-homing of deliverers, restaurants, and customers can be generated by survey.

Appendix Semi-structured questionnaire of interview

1) For restaurant owner, chef, or manager

- a. How long have you operated this restaurant?
- b. When did you start using the delivery platform or companies?
- c. What are the conditions of using delivery platforms:
- d. What do you think about the delivery system you are using now?
For example, feedback to platform by yourself, delivery calls allocation process or method, delivery restaurant registration process, calls reception time allocation, delivery platform usage fee, or promotion activity discount share and etc.
- e. How and when do you pay for delivery calls when you use the delivery platform?
Do you pay to the platform, to the drivers, or others?
- f. Are there any changes in benefits, including income or other intangible changes like company?
promotion, reputation, service promotion, customer satisfaction, etc., since using the delivery platform?

2) For deliverer (delivery rider)

- a. How long have you been a delivery driver? Which delivery platform are you serving for? If you are using multiple platforms, please write all platform names and your use ratio. What was your job before becoming a delivery driver?
- b. What are the main items for delivering?
- c. Please explain the delivery process such as 1) feedback to platform (On the platform, do you have a channel to send suggestions or problems to the platform during the delivering process?)2) driver registration process, including platform registration, delivery driver training program, morning or fixed term meeting, health certificate, ID certificate, bank information, go to company for an interview, etc., 3) calls allocation including platform allocation, driver application , 4) delivery evaluation by restaurants, customers.
- d. What is the average income per day in addition to call revenue style (according to the distance, stable payment of every call, or other), or Insurance (paid by driver, by platform, or by other) ?
- e. How long do you work each day?
- f. Please tell of your experiences with this delivery platform, and a special suggestion to the platform if you have.

3) For university students as customer of delivery platform

- a. How many times per week do you order food on delivery platform (including supermarket order, medicine order, etc.)?
- b. Which delivery platform do you mainly use? Can you list the platforms that you use and your ratio of use? Would you please introduce the platforms that you use and its' characteristic, the reason of using it in addition, and your feedback to the platform?
- c. Which kind of things do you often order? Did your orders this year increase or decrease compared to last year at this time? What is the increasing or decreasing ratio?
- d. What is the delivery charge? Who pays the delivery charge (restaurant, platform, delivery drivers, free, etc.)? How do you pay? (delivery platform, cash to driver, included in food cost) How do you decide on the food or restaurant when ordering?

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