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To cite this article: Jinhyo Joseph Yun, Xiaofei Zhao, Lei Ma, Zhiguo Xu & Zheng Liu (2023) Open innovation and multi-homing of delivery platforms: comparative study of Cardiff, Daegu and Nanjing, *European Planning Studies*, 31:3, 576-597, DOI: [10.1080/09654313.2022.2069463](https://doi.org/10.1080/09654313.2022.2069463)

To link to this article: <https://doi.org/10.1080/09654313.2022.2069463>



Published online: 02 May 2022.



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Open innovation and multi-homing of delivery platforms: comparative study of Cardiff, Daegu and Nanjing

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ABSTRACT

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 the 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 the restaurant industry in capitalist economies, the evaluation dynamics and focal points of the delivery platform industry, this study is based on an interview method in combination with participatory observation of deliverers, customers and restaurants of the three cities: (1) Cardiff with matured restaurant industry; (2) Daegu with an unmaturing restaurant industry; (3) Nanjing with the growth of the restaurant industry. The findings of this research are as follows: (1) Existing industries can disturb the growth of the delivery platform industry; (2) Multi-homing motivates a high labour state of deliverers, the acceptance of restaurants by customers and customer surplus; (3) Motivating open innovation in delivery platforms can maintain a high level after maturity stage. The study concludes that the balance between open innovation and the multi-homing of a three-sided delivery platform is the way to sustainable development to conquer the effects of the gig economy.

ARTICLE HISTORY

Received 2 October 2021
Revised 15 March 2022
Accepted 15 April 2022

KEYWORDS

Delivery-platform; open innovation; multi-homing; deliverer; restaurant; customer

1. Introduction

Despite the fourth industrial revolution, productivity slows due to exhausted opportunities and the world transforming with entrepreneurship decline as an exponential paradox (Pyka, Bogner, and Urmetzer 2019; Cooke 2019). Consequently, to conquer the growth limits of the twenty-first-century capitalist economy, technology and creative business models, combining technology, market and new business process software, are needed (Chesbrough 2019; Yun 2015). 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 (Yun et al. 2019). Among the O2O platform

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business models, the smart delivery business model receive significant attention regarding growth speed, gig economy and global expansion (Chesbrough 2007; Cusumano, Gawer, and Yoffie 2019). Therefore, this study focuses on the smart delivery platform industry.

1.1. Literature review on the platform

With the emergence of O2O ordering and delivery, many independent restaurants compete for customer orders placed by online smart platforms (He et al. 2019; Lu and Zeng 2011). 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 (Drahokoupil and Piasna 2017).

Platforms have several possible sources of positive consumption externalities: (1) from a direct physical effect on the number of purchasers; (2) from indirect effects that increase consumption externalities; (3) from positive consumption externalities that arise for durable goods (Katz and Shapiro 1985). 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; (4) low rivalry and loose control, such as Couchsurfing. Additionally, there are also Bemis Rider, Yogiyo and Bemis in Degu, Korea, between (1) and (2), as shown in Figure 1 (Constantiou, Marton, and Tuunainen 2017).

Through diverse O2O platforms, the transaction cost paid by potential buyers and sellers searching for each other reduces, and information asymmetry between buyers

Rivalry Between Platform participants	High	<i>Airbnb</i>	<p>China Nanjing; Meituan, Ele.me.</p> <p><i>Uber</i></p> <p>Korea Daegu; Bemis Rider</p>
	Low	<i>Couchsurfing</i>	<p>Yogiyo, Bemis</p> <p><i>Handy</i></p> <p>Wales Cardiff; Deliveroo, Uber Eats</p>
		Loose	Tight
		Control Exerted by Platform Owner	

Figure 1. Delivery platform typology in terms of control and rivalry degree, Source: Authors' creation based on models of sharing economy platforms (Constantiou, Marton, and Tuunainen 2017).

and sellers decreases (Spence 2002; Stiglitz 1973; Parker, Van Alstyne, and Choudary 2016). Digital platforms connect between previously unmatched demand-side and supply-side participants through innovative value creation, delivery and capture (Täuscher and Laudien 2018). 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 (McIntyre and Srinivasan 2017). Acceptance of O2O food ordering platforms by customers, restaurants and deliverers requires the perceived usefulness and the ease of use (Venkatesh and Davis 2000). 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 (Van Alstyne, Parker, and Choudary 2016).

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 (Zhang, Liu, and Feng 2019a). Some research on O2O food delivery platforms addresses the moderating role of moral obligations in meal preparation, customers, restaurants and deliverers (Roh and Park 2019), (Zheng et al. 2019). Diverse smart delivery platforms, such as Uber Eats from U.S., Meituan & Ele.me from China, and Deliveroo from U.K. and EU, Zomato & Swiggy from India, IFOOD from Brazil and Bemin or Yogiyo from South Korea, show that overall customer satisfaction on online food ordering platforms depends on various and dynamic factors (Raina, Rana, and Thakur 2019; da Silva Monty 2018; Todolí-Signes 2018). O2O food delivery platforms have powerful effects on restaurant sales through 'Ranking' apps (Zhang, Liu, and Feng 2019a). The impact coincides with customer recommendations on platforms, which become a basis of trust from customers in the food delivery system, especially with the increasing significance of healthy food choices in casual dining restaurants (Zhang, Liu, and Feng 2019a), (Kang, Jun, and Arendt 2015), (Pan, Wu, and Olson 2017).

Customer recommendations on O2O platforms are also diverse, including collaborative similarities such as choices from the same groups of customers, preference similarity like customer ratings and change similarity like the trajectory of customer choices (Pan, Wu, and Olson 2017). Attitudes towards food delivery apps, reflecting degrees of trust in food delivery e-commerce sites by deliverers, restaurants, and customers, depend on the perceived value determined by convenience, design, trustworthiness, price, food choice variety and household situations (Cho, Bonn, and Li 2019), (Liu et al. 2017). Restaurants face two opposing motivating factors simultaneously, such as (1) factors in favour of outsourcing food delivery to third-party online service providers, including increasing revenue and (2) factors against outsourcing online delivery services, including food-related issues (See-Kwong et al. 2017).

The job quality of the food delivery platform industry, which includes salary amount, enjoyment, autonomy, or other diverse factors, is not so good (Goods, Veen, and Barratt 2019), (Vandaele, Piasna, and Drahokoupil 2019). Although deliverer is an emerging occupation resulting from the booming of online commerce, social controversies, such as the high rate of road accidents in China due to the prevalence of unsafe riding and poor working conditions of delivery riders in Korea, occur (Pan, Wu, and Olson 2017). Deliverers of Belgian Deliveroo have fewer working hours and less income when transferred from company-employed to self-employed (Drahokoupil and Piasna

2019). Therefore, O2O channels can serve as a complement to, rather than a substitute for, the offline channel in the restaurant industry (Zhang, Pauwels, and Peng 2019b), (Djavanshir et al. 2017).

Multi-homing means that customers use several platforms together, weaken the network effect, especially the fully monetizing cross-side (indirect) network effect (Cusumano, Gawer, and Yoffie 2019). Therefore, reducing multi-homing is an important goal for all platform companies (Parker, Van Alstyne, and Choudary 2016). At any point, the likelihood of a winner-take-all in platform business will depend on the control of multi-homing (Cusumano, Gawer, and Yoffie 2019). Facebook acquired WhatsApp for 22 billion USD in 2014 to conquer the multi-homing (McAfee and Brynjolfsson 2017). Subscription business models in Amazon, Adobe or Apple music are classic examples of expanded network effects without multi-homing (Rossman 2016), (Tzuo and Weisert 2018).

As the antithesis of the traditional vertical integration model, open innovation, unlike the new ‘in-sourcing’ model of Tesla, is a distributed innovation process based on purposely managed knowledge flows across organizational boundaries (Tzuo and Weisert 2018). 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 (Chesbrough 2019).

1.2. Research question

Since the fourth industrial revolution, the smart delivery industry has been 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 (Mina, Bascavusoglu-Moreau, and Hughes 2014; Yun et al. 2020; Liu, Zhu, and Zheng 2019). Thus, the smart delivery industry will motivate new emergence and complexity for open innovation dynamics. The smart delivery industry demonstrates significant effects in the food sector and diverse manufacturing sectors, such as the drone and service industries (Liu, Zhu, and Zheng 2019). 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 the 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 delivery platforms of the three cities, we will find out the reality and theoretical points of three-sided delivery platforms, and the merits and deficiencies based on the similarities and differences of the three economies. The research is significant in finding the way to the sustainable growth of the delivery platform industry, conquering the negative effects of the gig economy.

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 and 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 a mature capitalist economy from the eighteenth and nineteenth centuries which has a well-developed restaurant industry; (2) Daegu indicates a partially developed capitalist economy from 1945 with a partially developed restaurant industry; (3) Nanjing represents developing capitalist economy from 1978 with the under-developed restaurant industry. Three universities, the University of South Wales, DGIST and the Nanjing university of Science, and Technology, were selected as similar research settings across the three countries.

2.2. Research framework

Normally, a platform ecosystem consists of two-sided actors, such as producers who create products for the platform, and consumers who purchase or use the products in addition to the platform provider who controls it (Van Alstyne, Parker, and Choudary 2016).

However, the delivery platform industry shows three sides, namely deliverer, restaurant and customer. In addition, the main components of delivery platforms are information and knowledge produced by the deliverer, restaurant and customer through interaction with the delivery platform. Hence, open innovation of knowledge or information 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 2](#).

First, we analyze three open innovations among smart delivery platforms and compare the differences in the economies. The smart delivery industry is evolving based on open innovation platforms with three main agents, as shown in [Figure 2](#), deliverer, customer and restaurant (He et al. 2019). In contrast to transaction platforms, innovation platforms enable ‘open innovation’ in various settings; Cusumano, Gawer, and Yoffie (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’ (Cusumano, Gawer, and Yoffie 2019, 20). 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 (Kemp 2013), (Martinez 2013).

Second, in this study, we compare the difference in multi-homing of all delivery platform players, namely restaurants, deliverers and customers, among the three economies ([Figure 2](#)). Multi-homing of the delivery platform occurs alongside the open innovation expansion because multi-homing means utilizing multiple platforms, which motivate the expansion of interaction among agencies (Eisenmann, Parker, and Van Alstyne 2006).

Table 1. Research method and research scope.

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

Actors in the delivery platform, such as deliverers, customers and restaurants use a multi-homing strategy when choice diversity, incentives and other benefits 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, as another factor of open innovation, we analyze the interaction of the three elements (restaurant, customer and deliverer) because the level and content of the interactions will affect open innovation directly and multi-homing indirectly.

From these steps, we will answer the research question about which can increase the sustainability of the smart delivery industry within a capitalist economy.

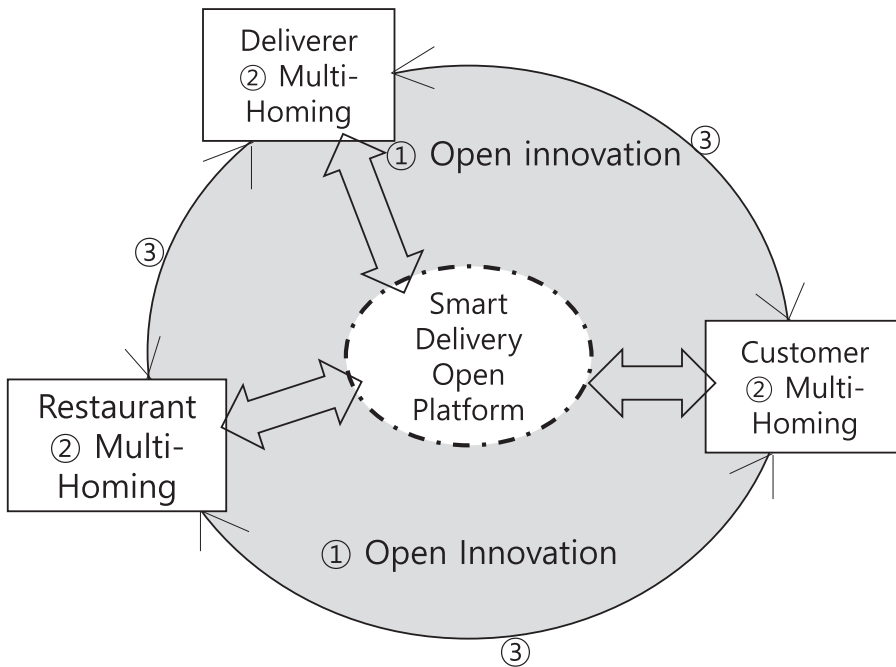


Figure 2. Structure and actors of a Smart Delivery Open Innovation Platform.

2.2. Research method

The research team mainly used the interview method with a semi-structured questionnaire for deliverers, restaurant chiefs or managers and university students as customers related to the delivery platform industry, as shown in Table 1 and Appendix. In addition, the participatory observation method for deliverers and restaurants (see Table 1) was used to explore additional statistics to compare the three cities. The interview method with a semi-structured questionnaire and participatory observation is useful to compare the delivery platform industry of the three cities motivated by different economic conditions.

Although the randomized control trials (RCT), which had been used by the winners of the 2019 Nobel economics have been used in several social experiment research studies on health insurance, prisoner rehabilitation, labour supply, worker training, or housing subsidies, there are several deficiencies including improper allocation of overhead costs, ethical issues of experimentation with human beings, limited duration of social experiments (John et al. 2011). From RCT, we developed a reflective comparison among economies (RCE), which concerns and compares targeted social groups (Figure 3). 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 the impact results of different capitalist economic situations by establishing reflective and highly meaningful groups. By comparing multi-homing and open innovation of three actors (deliverer, restaurant, customer) on the delivery platform among the three economies (Wales, South Korea, China) through qualitative research methods such as interviews and participatory observation, researchers will have more chances to detect grounded theories, which decide the evolution of delivery platform industry (Glaser

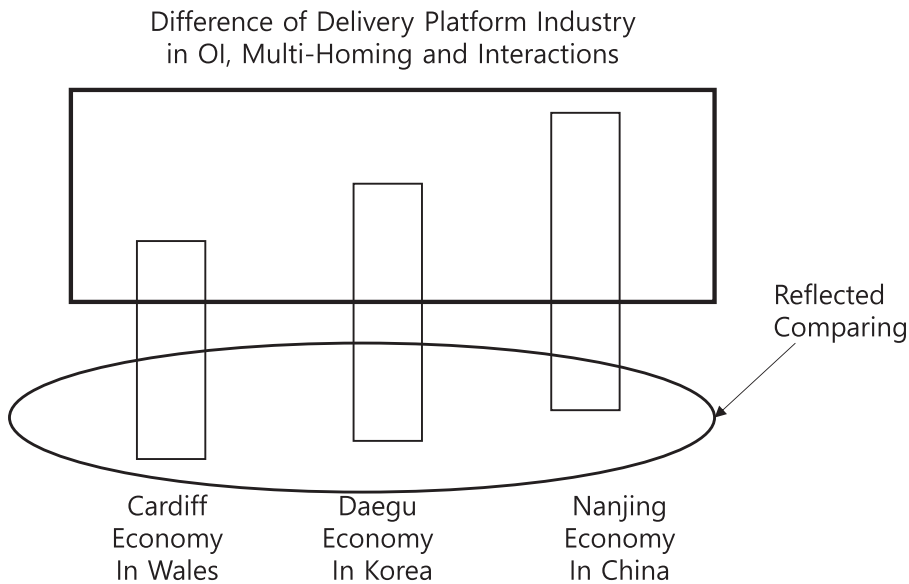


Figure 3. Reflected comparing among Economies.

and Strauss 2017). 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 (Ana et al. 2007; Russell et al. 2004). Through qualitative analyses and descriptive statistics, we compare the reflective effects of different capitalist economies based on the difference between open innovation and multi-homing in the smart delivery industry.

3. Smart delivery in three economies

3.1 Cardiff of 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 in Cardiff. Deliveroo is the most used platform in the United Kingdom. Customers can give an evaluation grade from one to five stars. Delivery and pick-up are possible, and restaurants can set the delivery time after receiving a customer order. Customers can order food for the 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 their ID to prove their age when receiving the food.

According to the semi-structured questionnaire about delivery platform usage, Cardiff restaurants are likely to communicate with platforms, providing and accepting ideas with medium-level open innovation with regard to menus, services and new systems, which are based on the multi-homing of other delivery platforms according to the interviews (see Figure 4).

Because Cardiff restaurants, with a long history and unique culture, do not utilize smart delivery platforms, the usage ratio of the delivery platform by the restaurant is

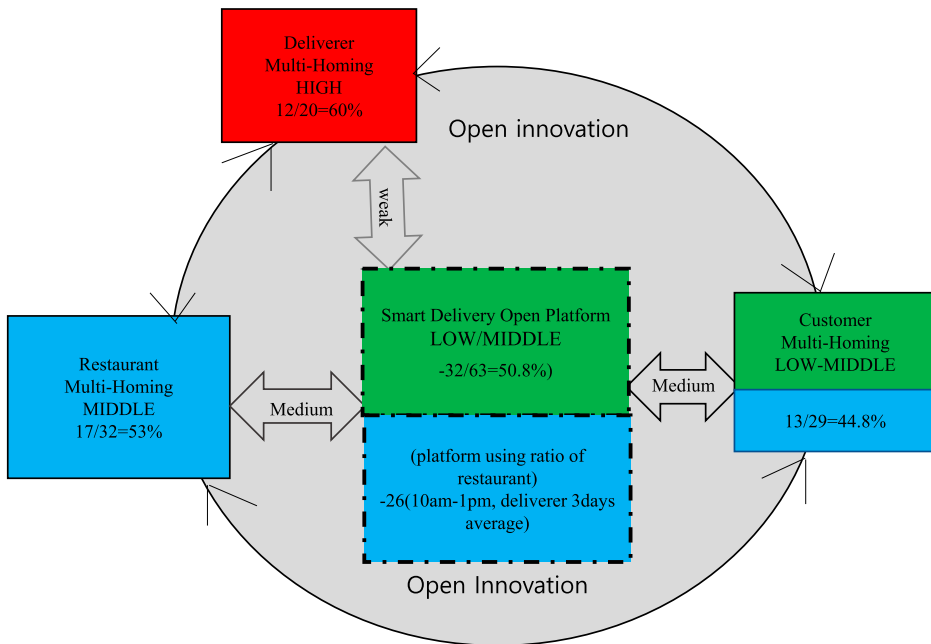


Figure 4. Smart delivery open innovation platform of Cardiff.

just 50.8%. This reveals that well-developed restaurants do not seek to use smart delivery platforms. Among the 15 restaurants interviewed, 11 belonged to big restaurant chains with a minimum history of 10 years.

Among Cardiff restaurants utilizing smart delivery platforms, only 53% used several platforms (multi-homing). The multi-homing ratio of Cardiff restaurants is low compared to Nanjing, but it is similar to Daegu. However, according to the interviews, the multi-homing of restaurants is increasing, to sell food and increase advertising.

In Cardiff, platforms receiving fees were 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 Cardiff 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 4). Based on the interview, some deliverers moved from multi-homing to using just one platform because they were earning enough from one platform.

Through participatory observation, 26 deliverers were active between 10 am and 1 pm on three days. The fewer deliverers do not motivate enough communication with a platform, which is a kind of open innovation. Although 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% of deliverers interviewed admitted that they had another job, which prevented them from enhancing open innovation with the platform. But, as a type of gig economy, deliverers in the Cardiff 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’s students from the 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 in Nanjing and similar to Daegu. Most Cardiff 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. Although customers can rate and comment on deliverers and restaurants, restaurants can also write opinions about customer behaviours and prohibit customers from commenting on the platform.

3.2. Daegu of South Korea

In Daegu, there were two main delivery platforms, Bemim and Yogiyo and several smaller delivery platforms during field research in 2019–2020 by the research team. In addition to smart delivery platforms, several deliverer brokerage firms employ deliverers and use the platforms. Currently, there are two types of smart delivery platforms in Korea, as shown in Figure 5.

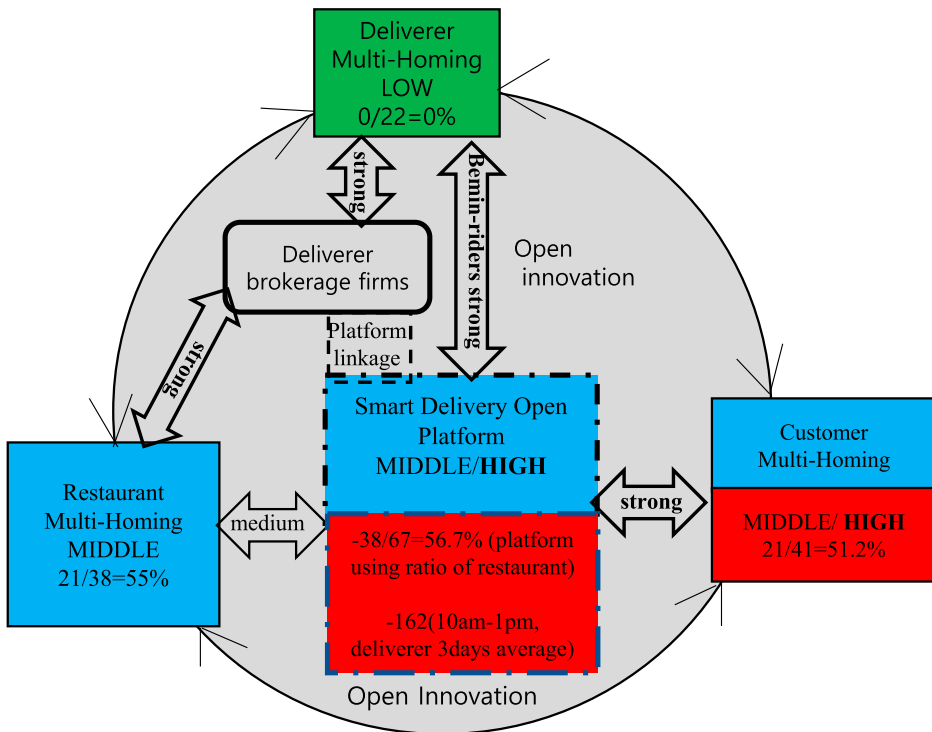


Figure 5. Smart delivery open innovation platform of Daegu.

First, most smart delivery platforms work with brokerage firms that provide deliverers and use the platforms. The main smart delivery platforms were Bemin, 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 Bemin-rider delivery platform, a minority smart delivery system unique to Daegu, does not collaborate with brokerage firms. Customers order from the Bemin smart delivery platform, and Bemin-riders follow the delivery requirements from the restaurants. After delivery confirmation, Bemin-riders deliver food and receive the delivery fee from customers or restaurants according to the distance.

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

Based on the interviews about delivery platform usage, approximately 56.7% of restaurants in Daegu used a smart delivery platform, higher than the Cardiff but lower than Nanjing (Figure 6). Korean restaurants have a long history of food delivery, making restaurants accustomed to brokerage firm-based food delivery platforms, which give restaurants confirmation of food deliveries to customers.

More than 90% of Daegu restaurants had delivered their food by themselves before they started to use a smart delivery system. More than half of the Daegu restaurants in our study paid all delivery fees if the food order amount was large enough; otherwise, only 30–50% of the delivery fee was paid by the restaurants.

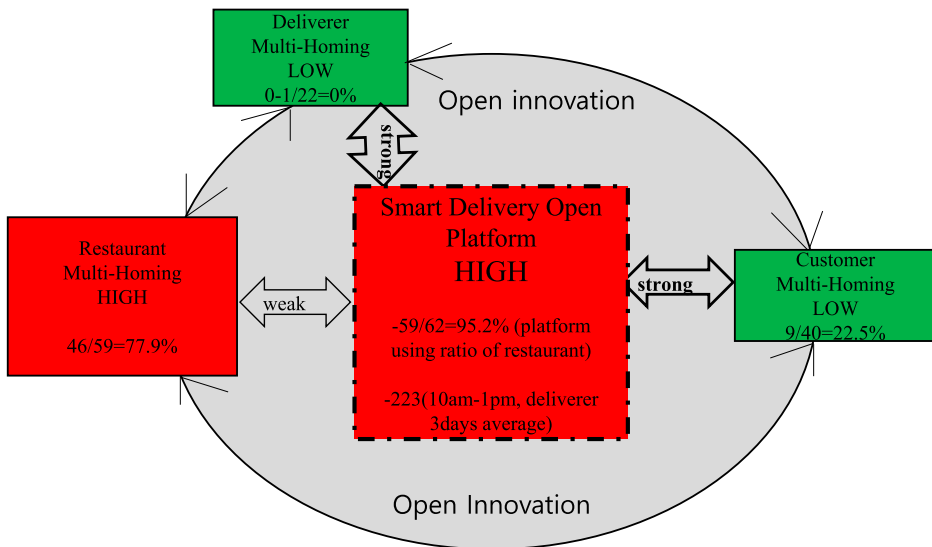


Figure 6. Smart delivery open innovation platform of Nanjing.

Among Daegu restaurants that use smart delivery platforms, 55% of restaurants used multiple platforms (multi-homing). The multi-homing ratio of Daegu restaurants is high compared to Nanjing but is similar to the Cardiff (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 Daegu restaurants: (1) the Bemin type is a monthly fixed payment (88 USD) + 3.3% ratio of the 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. More and more evaluations and comments from customers make it difficult for small and new restaurants to respond to platforms gradually.

Deliverers in Daegu were locked 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. The deliverer's average salary is between 2700 USD and 3300 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 motorcycles, helmets, delivery uniforms and rental.

Daegu deliverers communicate for high-level open innovation with brokerage platforms based on working time, working pattern, delivery course, etc. This is because they are locked in one platform like full-time jobs, and there is even an office for deliverers from the brokerage firms. Deliverers have strong communication with brokerage firms to receive new calls through platforms and communicate indirectly with restaurants and customers by calls or meetings. Bemin-riders communicate with the platform directly to accept new calls and connect with restaurants and customers through Apps. Compared to Nanjing, most Daegu 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 and 1 pm was 162. This active deliverer number is higher than Cardiff (29) but lower than 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 almost 12 h per day 6 days per week on average. Deliverers' working condition in Korea is more challenging than in Nanjing and Cardiff.

Customer participants who joined the questionnaire-based interview about delivery platform usage were 43 first- and second-year students at the undergraduate school of DGIST. Among them, 41 used delivery platform Apps, and 21 (51.2%) were multi-homing users. The customer multi-homing ratio of Daegu is higher than Nanjing

(22.5%) and Cardiff (44.8%). According to the survey, Korean customers' multi-homing ratio is decreasing, even though the usage of delivery platforms is increasing. Once the customers are used to one platform, with increasing familiarity with using the platform and accumulating customers' grades, they tend to use only one platform to receive more discounts or coupons.

Customers actively communicated through platforms to receive information about restaurants and gave feedback to restaurants about food and deliverers (Figure 5), which is regarded as a high-level open innovation. Customers of a smart delivery platform in Daegu voluntarily and diligently express opinions on restaurants and foods consumed. Korea's high-speed mobile internet infrastructure and strong, long-term experience in social networking services (SNS) cultivate these customer habits.

3.3 Nanjing of China

Ele.me and Meituan, have the biggest market share, and there are small platforms, such as DiDi, Dazhongdianping, and JD.com. 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 centre.

According to the results of questions on the delivery platform, 95.2% of restaurants in Nanjing used a smart delivery platform, which is high compared to Cardiff and Daegu (Figure 6). According to interviews, there are not enough restaurants in Nanjing to meet the requirement of the population. The vast number of customers use 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 Nanjing easily transformed into smart delivery platform-based businesses.

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

Among restaurants in Nanjing using smart delivery platforms, 77.9% used multiple platforms (multi-homing). The multi-homing ratio of Nanjing restaurants is higher than Cardiff but similar to Daegu (Figure 6). However, the multi-homing of restaurants is for advertisement effects and for selling food, which can increase take-out selling, according to the interviews with more than seven restaurants. 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 Nanjing 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, as well deliverers will face diverse penalties for rejecting calls from all platforms (Figure 6). In addition, several deliverers said they would not move to another platform because they are accustomed to one system and that another system is difficult to learn again.

With 223 deliverers active between 10 am and 1 pm an average of three days per week, this is significantly bigger than 29 in Cardiff and 162 in Daegu. This demonstrates the

high growth of the smart delivery platform in Nanjing. Nearly 100% of deliverers interviewed were working for food delivery as a full-time job compared to the Cardiff deliverers.

Nanjing deliverers who were locked in one platform as full-time jobs tried to communicate with the 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 use to apply the same direction calls, announce sustaining time limits, or maintain diverse platform requirements. Their communications with customers and restaurants are more frequent and direct because customers' and restaurants' good evaluations of deliverers can affect the delivery fees.

The situation of deliverers in Nanjing has a special meaning; most deliverers of Ele.me and Meituan work full-time, earning 1050–1350 USD every month, which is, even more, higher than a recent university graduate. Nevertheless, deliverers in Nanjing pay 0.15–0.75 USD damage insurance every day by themselves. Except for a distance-based delivery fee method, deliverers cannot reject calls assigned from the platforms. There are penalties for deliverers for not keeping delivery time limit, call rejection or bad evaluation from customers.

Customers in Nanjing actively communicate with and provide feedback for restaurants through platforms, which are 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 6). Customers in Nanjing communicate with deliverers through platforms about locations and delivery conditions. In addition, customers interact with restaurants regarding food ratings and services.

The customer interviewee was 40 sophomore students from the radio and television department of Nanjing University of Science and Technology, China. All were using delivery platform apps, and only 22.5% were multi-homing users. The customer multi-homing ratio of Nanjing is lower than the Cardiff (44.8%) and Daegu (51.2%). According to the interview, discount promotions, coupons and being accustomed to specific platforms reduce multi-homing. The ratio of multi-homing customers in Nanjing increased 20% over the last year, which is opposite to the case of Cardiff.

3.4. Comparing three economies in the smart delivery industry

First, on average, 223 deliverers in Nanjing, and 162 deliverers in Daegu were observed (three hours each day, total of three days). These indicate high-level open innovation in terms of high communication with platforms like Table 2. However, just 26 deliverers in Cardiff demonstrate a low level of open innovation in the sense that most deliverers have other jobs, and they do not try to communicate with platforms.

Second, 99.2% of Nanjing restaurants used delivery platforms. Restaurants in Nanjing showed 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 to platforms.

Third, in customer open innovation, Daegu customers perform strong open innovation with platforms, featured with middle-high multi-homing. This means the active

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–3h 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 h 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–3h 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%

development of a 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 the deliverer perspective show the early stage of the smart delivery platform industry. With the increase of open innovation with customers with sufficient multi-homing, the diverse development of the delivery platform business model can be possible.

4. Finding grounded theories

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

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

First, the weak growth of the Cardiff delivery industry results from the long history of a well-developed restaurant industry with active social relationships and traditions. This is found by interviewing restaurant owners and participatory observations of traditional restaurants in Cardiff which do not use delivery platforms. There is well-established protection of labour rights of the deliverer in Cardiff, which allow Cardiff deliverer to stop delivery any day any time without penalty, which is opposite to the situation of Nanjing or Daegu. In other words, the existing traditional restaurant industry hinders the growth of the smart delivery industry in Cardiff. The rudimentary condition of the Cardiff 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; (4) the popularity of delivery choices is highest among chain restaurants and cafes.

Second, Nanjing does not have a mature capitalist restaurant industry in the industrial revolution paradigm. The large population, and the fast growth of China's economy, in addition to the insufficiency of existing traditional restaurant industry, promote the rapid rise of the delivery platform industry in addition to the fast-growing up of pick-up restaurants and cafes in Nanjing. Even though the income of deliverers in Nanjing is comparatively higher than in Cardiff and Daegu, the rights of deliverers are not protected by platform firms.

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

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

The smart delivery industry is a three-sided platform industry whose growth depends not only on labour or capital, but also 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 protect deliverers and restaurants from platforms should be developed, including platform tax and social functions of platform firms.

According to the situation of Cardiff, high multi-homing motivates high labour state of deliverers such as allocation based on calls (platform cannot control deliverer highly), or no penalty for deliverer's call rejection by platforms. In the competition among platforms, restaurants in high multi-homing will not be controlled by platforms easily. In other words, the multi-homing of restaurants could increase the acceptance of customers about proposals by the restaurants through platforms. High multi-homing of customers can increase the customer surplus, such as the diversity of choice, freedom to reject platform policy or reduction of the fee for platform usage.

4.3. Motivating open innovation in delivery platforms can maintain high a multi-homing level of it after the 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 customers. Nevertheless, with the maturity of the smart delivery platform, the multi-homing of the three agents can be decreased, as shown on the left side (b) of [Figure 7](#).

However, if it is possible to highly motivate the open innovation of the three agencies before the maturity of the smart delivery platform industry, like the customer open innovation in Nanjing, or deliverer open innovation in Daegu, the multi-homing of the matured smart delivery platform can maintain at a high degree, as shown in on the right side (c) of [Figure 7](#).

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

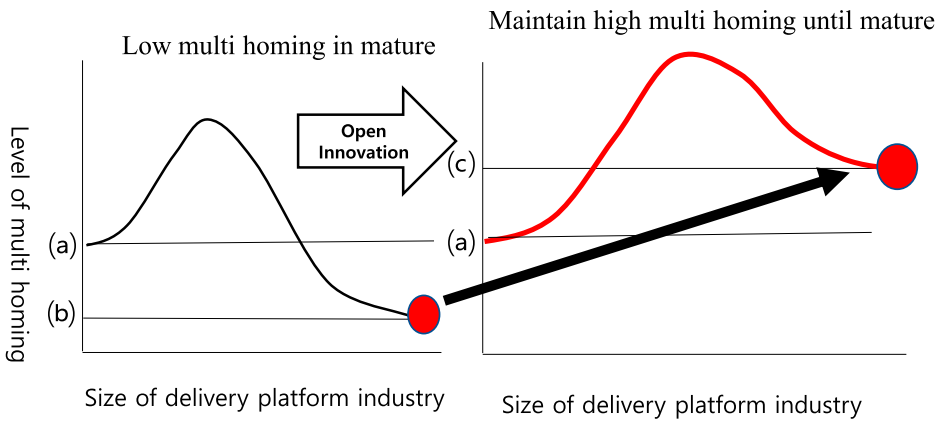


Figure 7. The way to maintain the multi-homing level high before the maturity of the delivery platform industry

5. Conclusion

5.1. Main findings

First, this study found that different economic conditions have effects on the smart delivery platform industry. An existing well-developed traditional restaurant industry disturbs the growth of the smart delivery industry like in Cardiff. Meanwhile, existing well-developed delivery brokerage firms hinder the development of the smart delivery platform industry like in Daegu. In Nanjing, the fast-growing economy and the emergence of take-away-oriented restaurants motivate the smart delivery platform industry.

Second, the high multi-homing of deliverers accompanies the increase in labour conditions 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 competition among delivery platforms. Besides, the multi-homing of customers can increase the customer surplus in delivery platforms, according to Daegu.

Third, high multi-homing without enough open innovation in the 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 of 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 surplus of component agents, not just with the platform itself. This study theoretically proposes a way to conquer the negative effects of the platform industry, which is called the gig economy, which is defined as ‘people using apps (also commonly known as platforms) to sell their labour (Vallas and Schor 2020; Wood et al. 2019). If any platform

can maintain the multi-homing at a high level, the platform is mature; the platform can reduce the negative effects of the platform industry to a level acceptable to the multi-sided agents.

In practice, industries have a great impact on the growth of the smart delivery platform industry. The existing and long-standing restaurant industry cannot match the 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 the relations between platforms and deliverers or between platforms and restaurants. There is a requirement for social contracts that define the new role of delivery brokerage firms and systems developed on the platformism, which include the roles of brokerage firms. Although the take-away-only restaurant or cafe industry can grow fast with the support of the delivery platform, new social contracts or technological system is required to check the food hygiene and the cleanness of take-out restaurants.

5.3. Limitations 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, an analysis of the structure, function, interaction, networking and the software itself of the smart delivery platform is needed.

Second, although we found three grounded theories, they are: (1) Existing industries in a capitalist economy can disturb the growth of the delivery platform industry; (2) Multi-homing motivates high labour state of deliverers, the acceptance of restaurants by customers, and customer surplus; (3) Motivating open innovation in delivery platforms can maintain a 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 the delivery platform industry alongside the lifecycle of firms and industries; (3) the dynamic relation change between open innovation and multi-homing in delivery platform industry with the growth of the platform industry. They could 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 on open innovation can be obtained from the database of delivery platform firms. Statistical information on the multi-homing of deliverers, restaurants and customers can be generated by the survey.

Acknowledgements

All authors thank professor Philip Cooke, the founder of the regional innovation system and EIC of European Planning Studies, in addition to all anonymous reviewers who gave valuable comments for authors to develop this study highly.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the DGIST R& D Program of the Ministry of Science and ICT, the Republic of Korea: [grant number 22-IT-10-02].

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Appendix

Semi-structured questionnaire of interview

1) For restaurant owners, chefs, or managers

- a. How long have you operated this restaurant?
- b. When did you start using the delivery platform or companies?
- c. What are the conditions for using delivery platforms:
- d. What do you think about the delivery system you are using now?

For example, feedback to the platform by yourself, delivery calls allocation process or method, delivery restaurant registration process, calls reception time allocation, delivery platform usage fee, promotion activity discount share, etc.
- e. How and when do you pay for delivery calls when you use the delivery platform?

Do you pay to the platform, the drivers, or others?
- f. Are there any changes in benefits, including income or other intangible changes like the company?

promotion, reputation, service promotion, customer satisfaction, etc., since using the delivery platform?

2) For the 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 the platform (On the platform, do you have a channel to send suggestions or problems to the platform during the delivery process? (2) the 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) call 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 the 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 a customer of the delivery platform

- a. How many times per week do you order food on the delivery platform (including supermarket orders, medicine orders, 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' characteristics, the reason for using it in addition, and your feedback on 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?

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?