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Understanding the diversity of final delivery solutions for online retailing: A case of Shenzhen, China

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Abstract

Since final distribution plays a significant role in the e-commerce logistics chains, it has drawn many stakeholders' attention and different solutions have been proposed to enhance the last-mile logistics. This is particular true in China, where the final parcel distribution systems are experiencing great challenges brought by the surging e-retailing. E-commerce companies, the third-party logistics service providers (3PLs), professional community delivery firms, real estate companies, and property management companies (PMC) focus collectively on the last distribution step from community gates to consumers' doorsteps. Despite many scholars in business management have investigated the classic patterns and related operation processes, little is known about the geographical variations of final distribution solutions themselves emerging in different urban areas. Taking Shenzhen as case study, the objective of this research is to understand the spatial diversity of e-commerce final delivery in this city with largest online transactions in China today.

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Keywords: Last-mile, e-commerce, retailing, delivery

1. Introduction

Final delivery, with a metaphor of “last mile”, refers to the last leg of goods movement from the last upstream distribution center, consolidation point or local warehouse to the final destination (e.g. recipients' doorsteps or specified pickup address). In the business to customer (B2C) e-commerce context, final delivery is one of the most

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complicated, expensive and inefficient segments along the whole logistics fulfillment chain (Gevaers et al., 2014). It is rooted in the particularity of e-commerce logistics (Maruntelu, 2008), for example, the frequent and larger number of small parcels or packages, the wide dispersion of recipients, constrained time window for delivery as well as high possibility of delivery failure. The inefficiency of home delivery leads to the high cost of last-mile delivery. In general, the last-mile delivery is estimated to amount to 53% of total logistics costs (Gol, 2001). The proportion sometimes can reach as high as 75% according to Onghena (2008). At the same time, last-mile plays a vital role in satisfying Internet purchasing experience. Consequently, the importance of winning final delivery of e-commerce has been recognized since the prevalence of e-commerce (Bromage, 2001; Lee and Whang, 2001). As many e-retailing giants (e.g. Amazon, and JD.com) believe that capacities of last-mile delivering are their core assets to obtain competitive advantages, the last-mile fulfillment is what the ongoing e-commerce battles are currently fighting for (Braunstein, 2015). Driven by customer demands and dominant players (e.g. e-tailing behemoths), conventional retailers and shippers forcefully strive to improve final delivery. On the other hand, professional community logistics operators and numerous startups are emerging one after another with innovative home delivery solution proposed. These schemes at least include self-pickup at convenient stores (Aoyama, 2001), collection-and-delivery points (CDP) (Browne et al., 2001; Mckinnon and Tallam, 2003), and unattended reception box (Punakivi et al, 2001; Esser and Kurte, 2006).

The striking industry changes are coupled with the rising of academic attention on final home delivery. A large body of literature available cover many issues deprived from last-mile fulfillment. Among them, typical ones include tracing innovative practices (Punakivi, 2001; Dell'Amico and Hadjidimitriou, 2012; Morganti et al., 2014), cost simulation and efficiency assessment for final deliveries (Kämäräinen, 2001; Kull et al., 2007; Gevaers et al, 2014), and modal choice (Esper et al., 2003; Boyer et al., 2009; Wang et al., 2014). The impact of last-mile schemes on logistics industry organization, urban transport and environment, freight transport planning have also been studied in depth (Taniguchi and Kakimoto, 2003; Cairns, 2005; Song et al., 2009; Edwards et al., 2010; Song et al. 2013). Despite the diversity of research topics about final delivery, few work is conducted to comprehensively understand all current schemes from the perspective of geography. Since final delivery actually is the last segment of goods movement in geographical space and time, the variation between different solutions largely lies in to what extent and by what forms that these solutions alert the spatial flow of parcels delivering along the dimension of time. It indicates a geographical perspective to examine the spectrum of final home delivery solutions. In addition, few literatures are available to examine the spatial deployment of last-mile logistics between and within different regions. The geographical disparity of last-mile delivery facilities is significant with less empirical research (Weltevreden, 2007; Morganti et al., 2014).

This study attempts to fill this research gap by unfolding the diversity of final delivery schemes within a city area and investigating geographical imprints associated with the interplays between final delivery stakeholders. Research question here is whether and how the co-existing end delivery solutions result in the spatial divergence of delivery facilities. Theoretically, conceptualizing the spatial process and consequences of different last-mile solutions enlarges the cross-discipline implications of geography on supply chain management. Practically, it shall enlighten policy makers to balance the disparity of final delivery in different areas.

The reminder of this paper is organized as follows. Section 2 presents a conceptual framework to understand the diversity of final delivery schemes as well as the geographical effect of their interaction grounding with urban physical space. Section 3 describes the case, data and methods. Empirical results about the strategies of different solution and corresponding spatial imprints in the case city are placed in Section 4 and 5, respectively, followed by the final section of conclusion.

2. Conceptualizing the diversity of final home delivery solutions

2.1. Briefing final delivery solutions: stakeholder and typical case

Although final delivery is frequently used in e-shopping today, this concept can be traced back to home delivery services provided by conventional shopping centers. Relying upon door-to-door delivery service, customers don't need to bring purchased goods home from shopping malls or stores. In the age of Internet shopping, home delivery becomes a key component to attract customers and reinforces its convenience of shopping anytime and anywhere. According to Barclay (2013), 70% of consumers prefer directly delivering to doorsteps. However, this dominant

preference combined with dedicated requirements has drastically increased the problems emerged from home delivery. With the prevalence of e-shopping, the spatially-unequal and temporally-fluctuated volume of parcels produces much more complexity to organize logistics planning and fulfill last-mile delivery, as they need to be delivered to end consumers dispersed in a wide geographic range with diversified geographic context. On the other side, the problematic final delivery has generated many innovative practices with objectives to accommodate to shopping behavior changes and improve delivery efficiency (Fig. 1). The common focus of different solutions is placed on how to provide alternative end delivery methods rather than heavily relying on the overloaded direct delivery by self-owned and outsourced logistics (3PLs).

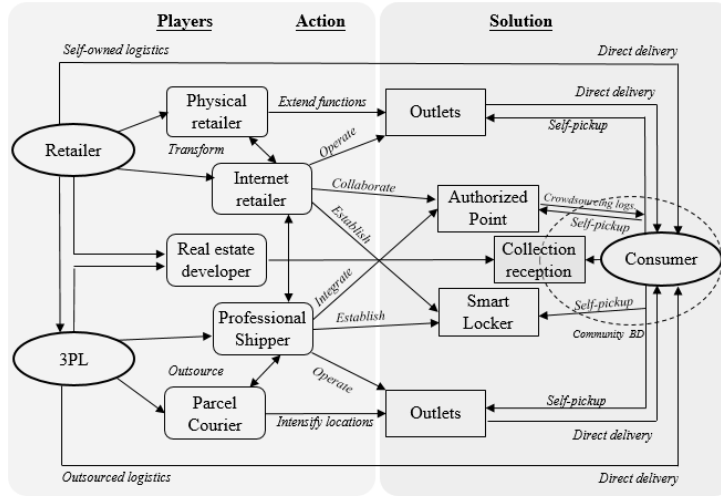


Fig.1. Diversified final delivery solutions

These alternatives are not only initiated by retailers and 3PLs along the e-retailing logistics fulfillment chain, but also driven by some startups focusing on last-mile delivery. However, as dominant players in e-retailing fulfillment chain, retailers and parcel couriers have adopted diversified strategies to extent their supply chains as close as to end consumers. Firstly, parcel couriers make it a priority to expand multilevel service stations (STs) and authorized services points (SPs) to enhance service quality (DHL, 2014). For example, DHL holds over 45,00 SPs in 2014, more than twice of 2020 SPs reported in 2010 (DHL, 2014, 2010). A large range of physical stores are authorized or annexed by couriers as in-store SPs for customers to drop off and pick up parcels. These stores include retail chains, convenient stores, small-sized grocery outlets, photocopies store and petrol stations. Secondly, retail giants, such as Wal-Mart and Tesco, have been actively transiting towards online click and offline collection (O2O). One unique foundation for them to deal with last-mile delivery is their widely-located stores network. The outlets functions have been transformed to embrace Internet shopping and adopt the omni-channel strategy. For instance, with 3,485 stores in the United Kingdom, items ordered on Tesco.com can be bundled and packaged for self-pickup by digit purchasers or direct home delivery from the nearest stores to customers’ doorsteps by a fleet of vans. The last but not least is that pure retail players have been enlightened by the attractiveness of click and collect model to operate physical stores. Except for currently cases that online retailers are moving to offline storefronts for demonstration and grabbing customers (Li, 2014), a series of Amazon’s getting-physical actions have much more implications for last-mile delivery. Except for expanding the pickup and drop-off stores piloted in Purdue University, Amazon is reportedly executing a plan to open physical drive-up grocery stores (Donato-Weinstein, 2015). These physical pickup spots are expected to help solve the last-mile problem of delivering perishable goods, which are carried by Amazon Fresh and expanding to major metropolitan areas in recent years.

A great many of professional last-mile shippers have been bred between the segment from the last upstream warehouse to recipient address. Parcel couriers and retailers can outsource final delivery business to them, and consumers can use them to collect and pickup packages as well. (1) Local delivery shipper, focus on the final leg of transportation with competitive advantages of specialized infrastructure network and familiarity to local traffic and build environment. For example, XPO Last Mile, the largest heavy goods delivery expertise with 28 operating

locations in USA, can provide tailored store-to-door delivery solutions and a wide range of value-added services, such as installation for in-home appliances and furniture. Especially in North America, this company have delivered and installed over 4.3 million appliances to 2.4 million addresses, which is more than any other group of carriers for any other 3PLs in the country of USA (XPO Last Mile, 2015). (2) Small-sized store integrator is one kind of emerging last-mile players who are dedicated to use internet technology platform to tie up a variety of small-sized stores into a well-connected collection and self-pickup network to help deal with last-mile delivery as well as reverse and return delivery. The spectrum of partner stores covers tobacco shop, bookshop, florist, kiosk, dry cleaning, gas station, clothing boutique, and optician stores. If requested, parcels can be redelivered by shopkeepers from these stores to customers, which is called as ‘last-mile crowdsourcing logistics’. One famous case is Kiala, which held as many as 67,000 points and handled over 145, 000 parcels per day before being purchased by UPS. Another one is CollectPlus, a UK-headquartered firm with over 5800 stores, which enable 90% of people who live in the UK’s towns and cities live within one mile of a CollectPlus store (CollectPlus, 2015). (3) Smart locker providers. Despite of smart locker has been in this world for a long time, it is not until the prevalence of e-commerce that smart locker is used to address the last-mile delivery. Fixed at residential neighborhoods, public transit stations or on streets, smart locker provide much more spatial and temporal alternatives for consumers to withdraw their packages, as well as lower costs for transport shippers (Augereau & Dablanc, 2008; Morganti, 2014). There are a lot of locker brands in European, such as PaketShop, Locker Bank, ByBox and Cityssimo (Niches, 2001). Although some law-related problems still need to be resolved, the number of locker is promising to have a steady growth in the future. The economies of scale, in turn, will facilitate smart lockers to play an increasing role in last-mile delivery.

Except for retailers, 3PLs and professional last-mile shippers, the role of real estate and property management usually has been neglected. Final delivery has to pass through the physical boundary of community. However, in practice, delivery workers are often not allowed to enter gated communities for security reason. Delivering to security counter at the doorway therefore should be a solution when customers are absent from home or delivery workers are not allowed to go in. Package management has thus become part of the daily workload for property management staff. Besides, installing unattended smart lockers, real estate developers and property management companies have piloted a lot of experimental projects. One famous case is the “Internet house” built at the end of 2000 by a Berlin-headquartered real estate developer, Quadriga AG. In this conceptual blue plan, groceries ordered by residents were delivered to a cupboard-like box fixed on the wall outside the apartment. Although this project has no further steps and news after the bankrupt of Quadriga AG, this innovative experiment has paved the way for further explorative practice. Some estate developers and property management companies formally have enlarged their service lists and established staff-assisted parcel collection receptions or unattended boxes. Similar cases can be observed at some Chinese universities, as the delivery by any 3PL is banned for gated university campus in China. For instance, Peking University is now using the Quadriga’ way to establish delivery boxes on its campus wall, one side facing outside for the delivery, the other side facing inside of campus for students.

2.2. Conceptualizing final delivery solutions: business model and spatial imprints

Owing to the popularity of online e-commerce, almost all stakeholders and new startups have been involved to change operation strategies and enhance logistics fulfillment to fit the ongoing shopping transition. Initiated by different players, these final delivery solutions have some similarities in despite of significant differences.

The difficulties of final delivery lie in sending parcels as many as possible to widely-dispersed customer under complex space and time constraints. Firstly, solutions abovementioned, in nature, devote to alert and reorganize the spatial flow of parcels going along the dimension of time (Fig. 2). It changes the paradigm of sending packages to customer doorsteps towards pre-specified collection-and-delivery points (CDPs) in the vicinity of receipt address. For consumers, waiting parcels at home are shifting towards picking up at nearby CDPs. Secondly, all these diversified projects intend to move the last upstream point of final delivery close to end consumer. Except for downscaling service radius of outlets, new CDPs are added along the delivery chain. These CDPs include intensified outlets, authorized points, and smart lockers. The last but not least, not only reduce transport distance and time cost for final delivery have been reduced, but also e-shoppers have more sites and time slots to choose from for collecting their parcels. Customer can choose any CDP to visit in accordance to daily trip chain. The new-defined final delivery, from CDPs

to doorsteps, can be outsourced again or crowdsourced in each scheme. It also shows much more flexibility in reorganization of final delivery chain.

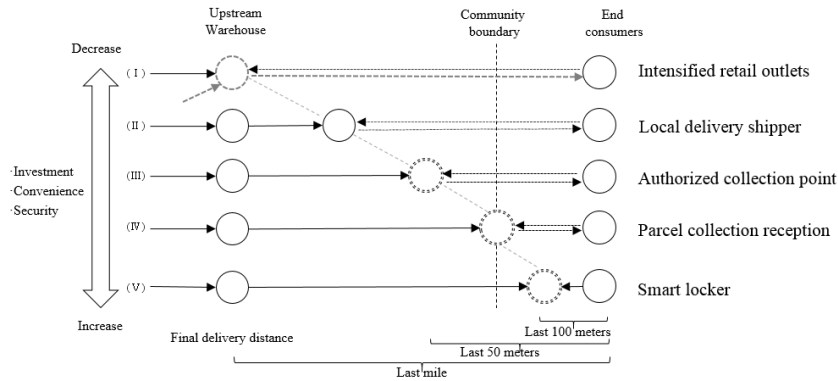


Fig .2. The diversity of final delivery solutions

In regard to cross-solution variance, the primary difference is how close the nearby CDPs are to consumers. From Models I to V in Figure 2, the distance between response points or CDPs and end consumers gradually get shorter, from the ‘last-mile’ to last 500 meters, then to last 100 meters. Correspondingly, the degree of convenience and security increase, while the investment on related network infrastructure increases drastically at the same time. In general, the convenience depends on the point density of CDP network and thus the minimum distance to doorsteps. Smart locker undoubtedly has advantages in regard to being close to end consumers. Nevertheless, building a wide-stretched network takes huge finance investment. It needs much more budget to establish a network of refrigerated lockers for collecting perishable goods. In addition, smart locker is much more suitable for items that don’t need to be checked by consignee. In contrast, small-sized store integrators can enable shopkeepers provide that service as value-added items. Therefore, mutual competition and cooperation between different solutions are universal according to market principles. Some complementary solutions are adopted by e-retailers and 3PLs to deal with home delivery. It triggers discussion about the interplays between different solutions and stakeholders.

The interplays between co-existing solutions of final delivery not only have produced significant diversity at the level of business model, but also generated spatial diversity when these solutions are grounded with physical space (Fig. 3). Their operation and expansion strategies have also encountered together in geographical space also contribute to the formulation of spatial diversity. In general, these grounding and expansion process are influenced by two groups of variables. The first group is related to the geographical distribution of consumers. The socioeconomic variations across geographical units are translated into demand density, which impels related players to take location-specific strategies. The most influential factor is residential density. Low-density residential areas usually are allocated less investment to deal with last-mile delivery. Affordable last-mile delivery service is preferable for low-income resident settlements. For community with high aging rate, delivery to doorstops is highly welcomed. The second group of factors are related to space availability associated with urban built environment. The availability lies in the provision of suitable land parcels and properties, entrance permission to residential communities, the number of stores for cooperation and other possible factors. For example, the outlets will be aggregated at some specific locations if available where rental price is relatively low. The layout of residential community has impact on the facilities of last-mile delivery. For high-dense community, the location of smart locker easily has the economic scale of users.

The disparity of socioeconomic and built environment make related stakeholders to execute varying strategies of final delivery at different regions. The interplays between different solutions at geographical space in turn formulate final delivery landscape within city, which are demonstrated as different features at different scales due to the hierarchical structure of geographical space. The objective of this study is to investigate what these spatial imprints are at different levels. In addition, this framework is beneficial to explain final delivery difference between cities with different geographic context, which are discussed in the empirical sections.

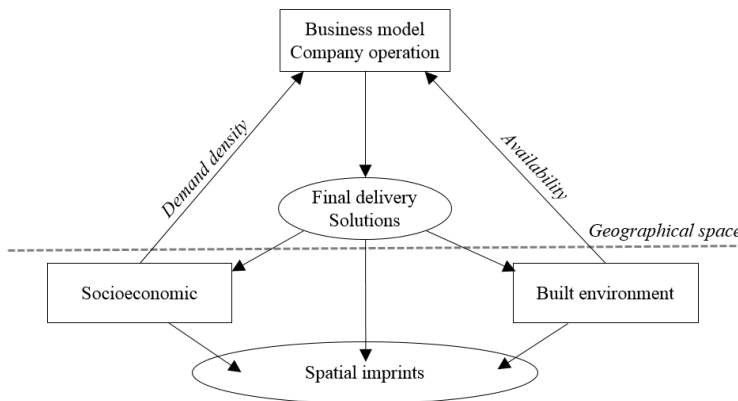


Fig. 3. The conceptual framework of final delivery solutions

3. Research Methods and Data Collection

3.1. Case city

This study is based on the case of Shenzhen, a top-4 China’s first-tier metropolis, which emerged from a fish village adjacent to Hong Kong after reform and opening up in 1980s. The city is selected as the case for the leading advance of retailing eCommerce and logistics in this city. In 2014, the total online retail consumption of Shenzhen reached ¥ 94.41 billion after a continually steady growth over last decade. The booming retailing eCommerce and online shopping has significantly promoted the increasing of parcel delivery express industry (Shenzhen Statics Bureau, 2015). In 2014, the total number of parcels sent from/to Shenzhen is 0.95 billion, where at least 50% of parcels are estimated to be generated by eCommerce. Each citizen averagely has sent and received 88 parcels in 2014 (Shenzhen Postal Administration Bureau, 2015).

The rapid industry growth of e-shopping and huge delivery demands exacerbate the problem of last-mile delivery. A multiple of market players have participated in this market. Some innovative alternative modes have been implemented, such as CDPs and smart lockers. However, parcel express infrastructure still is not desirable. The number of intelligent locker is less than 2,000 in the whole city. Moreover, e-commerce and logistics shows varying grounding paths across different regions with diversified built environments in this city. Specifically, in spite of being highly urbanized over last three decades, evident is the disparity between central area (original special economic zone, SEZ), inner and outer suburb areas (out of SEZ). The sandwich structure of urban space generated along the history of this city, have accelerated the spatial unevenness of parcel delivery facilities within this city. In addition, due to the high-urbanized condition, vacant land provision is limited, implying fierce competitions and potential cooperation between stakeholders to organize delivery facilities and fulfillment chains. Therefore, it is worthwhile to use this case to examine the interplays between different final delivery solutions and their geographical imprints.

3.2. Methods and Data

Research are *mainly* conducted by qualitative methods, including case study and in-depth interview. The qualitative research set out to collect data about the strategies used by logistics operators, retailers and other stakeholders involved in last-mile delivery (Table. 1). In total, six individual face-to-face interviews were conducted by using semi-structured questions (dealing with their strategies on ecommerce and end-delivery). 5 presentations addressed by senior managers affiliated to 5 companies were selected from 20 related presentations. All these 11 companies are top in their industries. Interviews with shop-keepers and delivery men by semi-formal ways are beneficial to probe the operational reality of last-mile solutions.

Table. 1. The profile of interview

Category	Name	No.
Delivery operator	SF Express, YD Express, UC Express	3
Internet retailer	Yhd, Alibaba, JD.com	3
Conventional retailer	Tianhong	1
Smart locker provision	Sposter, Baowu	2
Real estate developer and property management firm	Vanke, Color life	2
Shopkeeper	-	4
Delivery man	-	5

Except the data collected by interviews, other data sources cited include annual reports, firm's announcements, industrial research reports. As official statistics data are limited, a few articles written by practitioners are used after peer-to-peer verification. All these data sources are complementary to portray the diversity of end-delivery in Shenzhen.

The geographical addresses of retail outlets, CDPs and smart lockers of cases in this study are mainly drawn from corresponding firms' official websites, including STO Express, SF Express and other firm. Some data is collected as points of interest (POIs) through application programming interface of online map platform (www.baidu.com). The longitude and latitude for each address and POIs is obtained by geocoding program. Geographical visualization and analyses are completed by Arc GIS 10.0 platform. The analysis approaches and instruments used are discussed in related section.

4. The co-existence of final distribution solutions in Shenzhen

Similar to conceptualized model, a variety of final delivery solutions are co-existing in Shenzhen. Related cases are studied in this section with more attentions on their spatial strategies to see how different solutions are operated in Shenzhen.

4.1. Outlets-based Models in Shenzhen

The outlets operated by retailers and 3PLs are the main channel to address end delivery. Except for conventional retailers who intensify their outlets distribution and develop self-pickup functions, more representative cases in point are related actions conducted by SF Express and Alibaba in Shenzhen.

The expansion of SF outlets in Shenzhen

SF Express, the largest private parcel couriers with dominant advantages in high-quality parcel express industry, have done much more work in enhancing end delivery. Due to their headquarters located in Shenzhen, some innovative business experiments are firstly piloted in this city. Prior to the ambitions plan of developing unattended smart lockers (HIVE box), much more effort has been placed to expand and intensify attended outlets. Traditionally, final delivery is organized in accordance to self-owned service stations. As a micro-consolidation center, parcels are send from upstream transship centers and delivered to consumers. Each service station has an independent service zone, equivalent to the street-level jurisdiction in Shenzhen.

To intensify outlet distribution, a batch of chain stores was authorized for customers to drop off and pick up parcels (Table. 2). To guarantee the service quality, SF prefers to cooperate with chain brands having high market reputation. The majority of their authorized partners are well-known CVS chains such as 7-Eleven, Polison, and BLH. In 2013, this authorized point model was upgrade into SF store where some goods can be purchased. The model was upgraded again with a concept of Heke store in 2014. At that year, SF initiated an ambitious plan to open over 1000 Heike stores in China's top metropolises. In Shenzhen, about 150 conception stores have been finally opened. At the same time, they downscaled each service zone and divide the whole city area of Shenzhen into 52 zones. A multilevel hub-and-spoke delivery network is established for each zone to support collection and delivery business.

Table. 2. The diversity of SF Express's outlets

Category	No.
Service station	52
SF store	118
Heike Store	150
Authorized points	427

Based on the actions abovementioned, SF have always on the way to enhance final delivery. As a professional express firms, their strategies are placed more on the spatial organization of logistics planning. One senior managers from SF in our interviews said,

To address the problems of last-mile delivery, it needs different playing strategies. Our objective is to use space to deal with time (yong shijian huan kongjian) • • • enhance the density of all-types of service points, reduce response time • • •

Among all these measures, the most controversial one is the plan of Heike store. As an upgraded vision of SF store, facilitating parcel collection and pickup is one hand, promoting SF self-owned online retail business of fresh items and imported goods is the other hand. These businesses are on the basis of the strong logistics network held by SF Express. However, this ambitious plan of Heike hasn't been implemented as SF expected. The failure is rooted in the business model of Heike which try to sell items to customers without sufficient inventories but heavily rely on their self-operated logistics fulfillment. After one year, the chain of Heike store is transited to SF home. SF home, is positioned as the offline outlets of SF Best.com, one e-commerce portal for fresh and perishable food operated by SF Group. Although the work piloted by SF to develop online shopping based on offline logistics and last-mile advantages is challengeable, these pioneering work still are beneficial for addressing end delivery and encouraging other offline and online innovation practices.

Alibaba's collaboration with conventional store chain Meiyijia

Unlike the path of SF from offline to online, Alibaba, the largest online retailing marketplace operator in China, has made much more effort investment on offline CDPs. One of their successful strategies is to cooperate with Meiyijia since 2012, the largest convenient store (CVS) chain in Pearl River Delta. According to this cooperation, more than 3,000 Meiyijia stores can be selected by e-purchasers as CDPs on Tmall.com/Taobao.com. In Shenzhen, 1030 stores joined in this program of Tmall service station, which are renamed as Cainiao service station in 2014 after Alibaba strengthen investment on logistics by their subsidiary Cainiao logistics.

It is notable that this cooperation is based on dedicated consideration by Alibaba to enhance final delivery service in suburb areas. Since a large proportion of purchasers on Tmall.com and Taobao.com are low-income residents living in suburban areas, who prefer low-price services by franchised logistics operators (YTO, STO, ZTO and YD Express) rather than self-operated SF. However, the deployment of CDPs by logistics operators in suburb is not so dense as that in central areas. This partnership with Meiyijia, whose stores are mainly located in suburb areas and urban villages, have significantly improve end delivery for suburb residents and low-income populations. Market competition strategy has led to a well division with SF and Cainiao CDPs in regard to final delivery (Fig. 4).

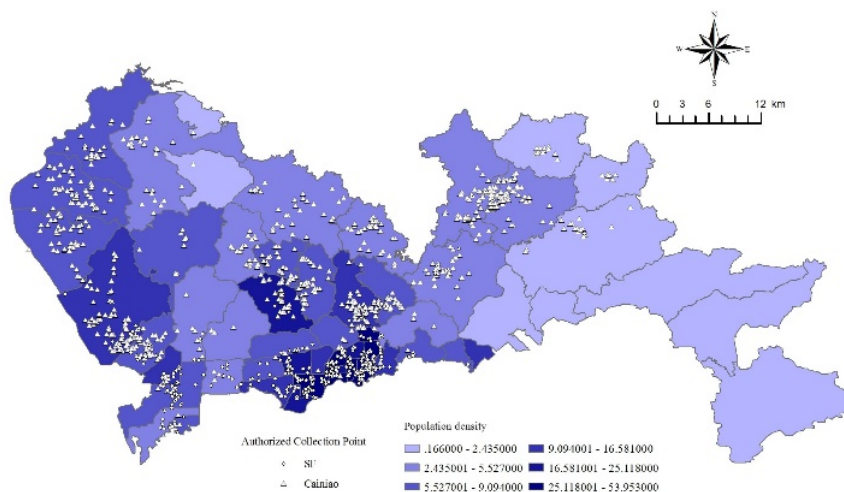


Figure. 4. The distribution of Cainiao and SF's authorized points in Shenzhen

Retailer-initiated stores for final distribution

The huge investment by online retailers and 3PLs increase the pressure for conventional retailers to transform business model and logistics fulfillment operation. Rainbow (Tianhong), a conventional retail giant in Shenzhen, is actively adjusting themselves to accommodate the popularity of internet shopping and home delivery. With the web-marketplace (<http://www.tianhong.cn/>) and mobile shopping appliance, Rainbow is accelerating the transformation towards an online and offline retailer. Accordingly, the strategies on physical retail outlets and delivery business have also been adjusted to fuel this transformation. Apart from redefining shopping malls in the era of e-commerce, two strategies are related to home delivery. (1) The priority of new expansion is placed on the community-level shopping mall with floor areas of 30,000-50,000 m². The underlying reason is that this type of small-sized shopping mall is much more close to customers. The interior environment has been specifically designed as well. They aim to reobtain customers' preference by the fashionable click- and scan-shopping, pickup and home delivery. (2) Open convenient stores. 13 CVSs already have been opened in Shenzhen since January, 2014. In these O2O (weiwo) CVSs, a wide range of items and daily life services are provided, including home delivery of fresh food, flowers, finance service, photocopy, parcel collection and other services.

The accumulated experience in retail industry facilities Tianhong to conduct well in this adjustment. “Compared to Heike, our Weiwo have sufficient inventories and excellent replenishment system”, one operation manager said in our interview, “Rainbow is a mature retailer with a strong self-operated logistics and home delivery network, while SF just expertise in express delivery”.

4.2. Professional community logistics providers

Small-sized store integrators in Shenzhen

Although there are quite a few startups in Shenzhen which are striving to unit small-sized stores to help e-retailers and parcel couriers to deal with end delivery, the famous case is Mail World (Maowu) established in 2013. The business model of Mail world is similar to their international counterparties (e.g., Collect plus). Parcels can be sent to the nearby stores, and customers can visit these stores to pickup service on the way home. Logistics operators pay the subsidies to these contracted stores. If requested, parcels also can be delivered again to customer doorsteps by shopkeepers. Mail World' work is to expand the network, provide internet devices, train shopkeepers and establish standard operation procedure. Therefore, Mail World is a light-asset company playing as an intermediary and supervisor in the inbound process loop of the last-mile collection and self-pickup (re-delivery).

During the first three months after establishing, this company managed to integrate more than 1,000 stores and became a logistics partner of Alibaba. All stores under the flagship of Mail World were recommended by Taobao.com/Tmall.com as optional self-pickup points to e-shoppers from Shenzhen when they check out. To stimulate collect & pickup service and improve purchase experience, Tmall.com offered e-shoppers coupons and paid subsidies to Mail World and stores. This double-subsidy business policy bred a thriving growth of Mail World in 2014. However, after Alibaba decided to develop self-owned CDP network, this startup fell into shade rapidly. Mail World is transiting towards a community-based logistics service provider, just like their new name as ‘neighboring boys’. They promise that all the orders can be fulfilled within one hours using their crowdsourcing logistics solution. Similar to Heike, Mail World’s business exploration did pilot a new type of end delivery scheme and have implications for the O2O economy and shared economy as well.

Smart parcel locker in Shenzhen

Driven by online retailing, smart locker has witnessed a rapid growth during these years. According to incomplete industry statistics, the number of smart lockers fixed is soaring to over 2, 000 in Shenzhen. Quite a few market stakeholders are fighting for market share in this last 100-meter delivery segment. The fore-runner in Shenzhen is eStation (e zhan) (CSL, 2015), followed by Sposter (sudiyi) and yhg (yihaogui) with 300-400 lockers respectively (Figure. 5).

The geographical distribution of lockers fixed in Shenzhen is presented in Figure 6. The density of smart lockers installed is higher in central than suburb areas. Some brands such as eStation, recently, turns to newly-constructed communities in suburbs. Since the commercial environment is not desirable as that in central areas, residents are willing to purchase a larger range of items online, such as groceries. The insufficiency of delivery service in suburbs contribute high demands to install smart lockers. At the level of built environment, the large scale of street leads to delivery men are willing to pay the usage fee in order to send more parcels and avoid unnecessary waiting time. New residential communities usually have more vacant space to install smart lockers at the level of ground floor have also contributed the growth of locker in suburb.

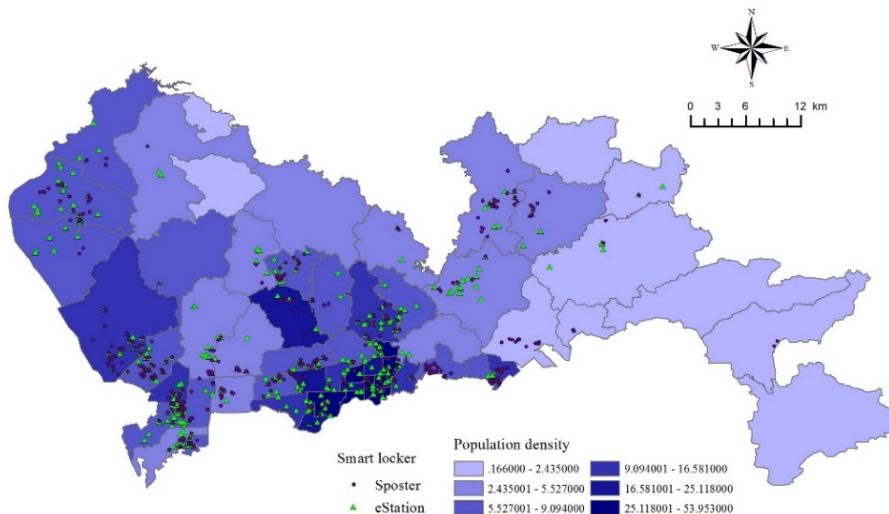


Figure. 5. The geographical distribution of smart locker in Shenzhen
 (Source: <http://c.dituhui.com/>, updated in March, 2015)

4.3. 4.3 Real estate developers and property management

The first solution is to provide smart lockers for customers. In Shenzhen, Fantasia Holdings' management unit, Colour Life Services are collaborating with Sposter to install smart lockers for their residential projects. This effort is

a part of community-based online and offline ecosystem proposed by Colour Life Services. This ambitious scheme plans to connect their tenants and nearby retailers and service providers around community on the cyberspace. The online-verified orders for home delivery are fulfilled by crowdsourcing logistics solutions.

Major property developers such as Vanke are also seeking the breakthrough to address the troubling issue of home delivery. A project called Happy Stage (xingfu yizhan) are carried out with aims to provide a large range of daily services for residents. One of the major businesses is to assist residents to send and receive parcels. Happy Stage has signed cooperation agreements with many well-known parcel couriers. Collection and pickup service are provided to parcel couriers and customers. Each parcel collected will be paid one yuan by couriers. The total fee charged will go into revenue of the property management for all residents. At the other end, picking up parcels is free for customers. For the senior, disabled, sick and pregnant women, parcels will be internally delivered by property management staff. Each parcel can be kept attended for three days. Beyond the time range, each parcel will be charged one yuan per day. Parcels which aren't picked up within seven days will be returned to delivery companies.

In an interview, new directions of Vanke are disclosed. New community logistics facilities will be taken into consideration for newly-developed residential projects at the stage of planning and architecture design. These facilities include logistics-specific parking space, pickup boxes and micro distribution stations. In addition, Vanke will go on to promote “logistics estate plus” at the level of community, which means to fulfill service demands by innovative logistics estate solutions.

5. The spatial imprints of co-existing final delivery solutions

5.1. Intensification

The first spatial consequence generated by the coexistence of end delivery solutions is the intensification of intra-city delivery facilities. Virtual e-shopping occurs anywhere and anytime, whereas physical business and logistics activities are concentrated in the vicinity of residential communities. Due to the prevalent customer-centered philosophy, the response points of e-commerce supply chain are moving close to end consumers to organize retail and home delivery. Retailers have repositioned their operation strategies of physical stores. The value of convenient stores is being recognized as an important network to adopt new shopping behavior. Quite a few new types of concept stores, such as community-specific shopping centers, and drive-in stores, have emerged around residential communities in Shenzhen and other cities in China. The underlying basis is the improvement of supply chain operation capacities. Innovative business practices in end delivery have fueled this process.

The downscaling process has significant influence on 3PLs. To reduce the delivery time, parcel couriers have intensified their outlets distribution within city areas. For the top nine parcel couriers in Shenzhen, the number of service stations averagely is equal to the number of street-level jurisdictions (Table. 4). As a new type of urban elements, the increasing density of retail store, to some extent, changes the commercial structure landscape in Chinese cities.

Table. 4. The number of parcel courier outlets in Shenzhen

Express	No.
STO	68
YTO	49
ZTO	43
Best	69
Yunda	48
GTO	69
SF	58
UC	52
ZJS	48
Mean	58

5.2. Disparity

Although intensification occurred across the whole city, this process varies across different parts of the city. In Shenzhen, the majority of service points are concentrated at major district centers, i.e., Luohu, Futian and Nanshan districts (Figure. 6). Along with the population pattern moving to the west-eastern (Baoan center) and North part (Longhua), the density of service network is also higher in these newly-development areas. Owing to the self-contained interdependence of Shajin and Longgang, two sites are hot spots in the outer northwest and northeast.

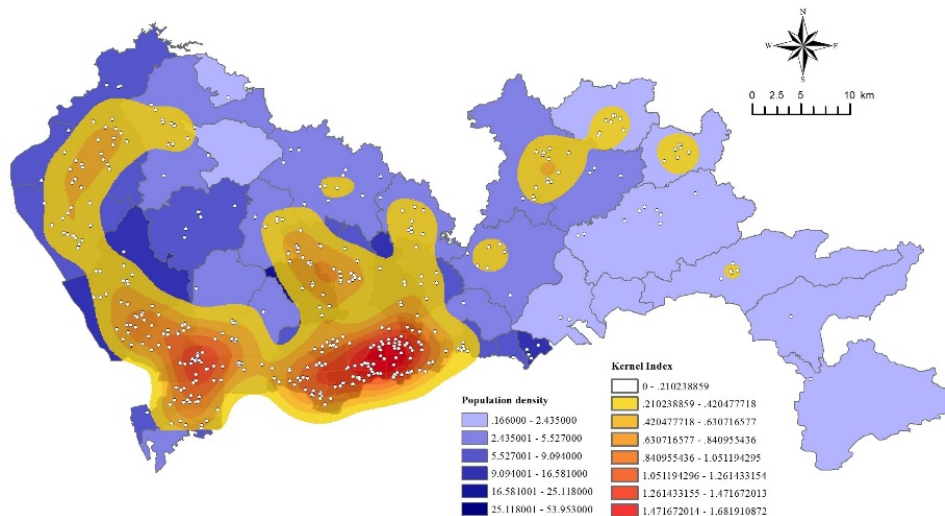


Figure. 6 The geographical disparities of service stations in Shenzhen

Another dimension to measure the disparity of authorize points is about the time, including access time to and service time of these points. The authorized points are well-known chains, the majority of which offer 24×7 service for e-purchasers and self-pickup users. On the contrary, the authorized points of Cainiao logistics and other 3PLs in suburbs are usually small-sized franchised stores with limited service hours per day.

5.3. Agglomeration

The last but not least, space imprint is that a lot of service stations are co-located in some specific locations. These co-located sites usually have strategy implications for market expansion. For example, Huaqiangbei, the largest electronic marketplace, has the highest density of service stations. Co-location effect may occur in somewhere the vacant land parcels and properties suitable for end delivery service is limited. It is an option to fill the gap between industry demand and space availability. The social connection also plays important role in the spatial agglomeration effect. To reflect the co-location effect, all service station sites from top 9 parcel couriers are allocated into 500 meter × 500 meter cellular network according to longitude and latitudes in GIS Platform. In total, all 465 sites take 362 cells. Specifically, 20% of these cells have more than 2 service station sites (Figure. 7). Especially, 4 cells have more than 4 stations co-located.

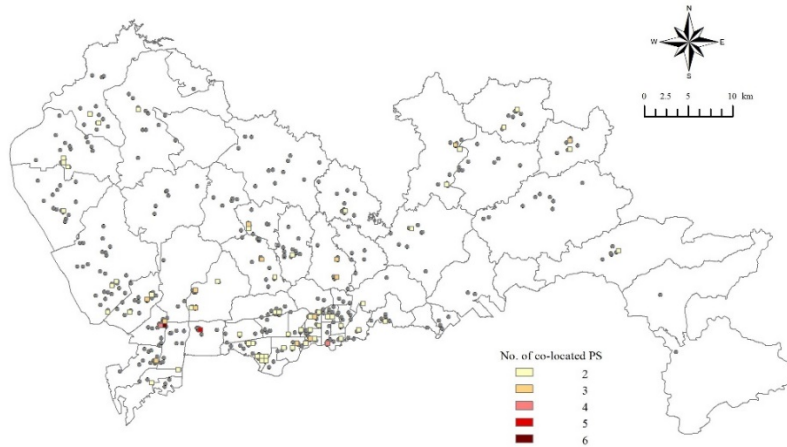


Figure. 7. The agglomeration sites of service stations in Shenzhen

Beside industry parks and logistics parks, a large part of service stations are located in urban villages, where the rent price is relative low and population density is high (Table. 5). The widespread urban villages are the legacy of Shenzhen’s rapid urbanization over last three decades. It provides low-rent space for the fast-developing e-commerce logistics to deploy service stations and CDPs within this city.

Table. 5. The agglomeration site in Shenzhen

	Central districts	Suburb districts
Urban Village	Shazui(FT), Chiwei(FT),Tianbei (FT),Sungang(LH) ,Yucun(LH), Cuizhu(LH)	Xiangqian (LG), Xintang (LH),Yangma(LG), Shuidouwei(BA),Xiawei(BA),
Industry Park	Tairan(FT),Liantang(LH), Maijialong(NS), Nanyou(NS), Shahe(NS), Honghualing(NS)	Longteng(LG), Jinfanghua(LG),Xiashijia(BA), Fenghuanggang(BA),Cuigang(BA)
Logistics park	Meiyuan(LH)	Danzhutou(LG),Huanancheng(LG)

6. Conclusion

The popularities of home delivery associated with Internet shopping have driven all the stakeholders to accommodate this big trend. Since the bottleneck effect of final delivery in e-shopping fulfillment chain, a variety of end delivery solutions have been proposed and carried out by relate stakeholders and startups to enhance delivery efficiency. However, less work is conducted to give a framework to understand all these diversified solutions as a whole. From the perspective of geography, we argue that all these solutions attempt to reorganize the spatial flow of parcels delivering going along the dimension of time. With different approaches, they want to move the response points close to end consumers. However, this downscaling process in reality is constrained by the spatial variation of socioeconomic and built environment. The spatial disparity of demand density and space availability have enlarged the diversity of end delivery solution from the business model level to spatial level.

The co-existence of different delivery solutions and their interplays when grounding with geographical space generate multilevel spatial imprints. The diversity of solutions and the complexity of city have shaped new landscape of end delivery. Although the intensification of service points and outlets or smart locker are occurred simultaneously, but this process hasn’t been occurring equally. The geographical disparity of service points, authorized points is distinctive. This unevenness is not only shown at the density and access time, but also differs at the service quality and time. At the micro level, the agglomeration effect is much more significantly connected with local built environment. It suggests that the provision of home delivery is deeply rooted with the geographical space albeit placeless is internet shopping.

This study has some implications for future research to shed more lights on the spatial competition of conventional retailers and the partnership of e-tailers and couriers. In addition, much more work can be done to illustrate what factor leads to disparity of service points and access time by the geographical weighted regression model. Finally, it would be interesting to further explain the location decision of service stations, especially from the perspective of actor-network theory.

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