

Summer 5-27-2016

# Urban Logistics under the Internet

Xiaoxia Wang

*School of Traffic and Transportation; MOE Key Laboratory for Urban Transportation Complex Systems Theory and Technology, Beijing Jiaotong University, Beijing, 100044, P.R. China, xxwang@bjtu.edu.cn*

Zhanqiang Li

*School of Traffic and Transportation, Beijing Jiaotong University, Beijing, 100044, P.R. China*

Yanbo Cui

*School of Traffic and Transportation, Beijing Jiaotong University, Beijing, 100044, P.R. China*

Follow this and additional works at: <http://aisel.aisnet.org/whiceb2016>

---

## Recommended Citation

Wang, Xiaoxia; Li, Zhanqiang; and Cui, Yanbo, "Urban Logistics under the Internet" (2016). *WHICEB 2016 Proceedings*. 46.  
<http://aisel.aisnet.org/whiceb2016/46>

This material is brought to you by the Wuhan International Conference on e-Business at AIS Electronic Library (AISeL). It has been accepted for inclusion in WHICEB 2016 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# Urban Logistics under the Internet

Xiaoxia Wang<sup>1,2\*</sup>, Zhanqiang Li<sup>1</sup>, Yanbo Cui<sup>1</sup>

<sup>1</sup>School of Traffic and Transportation, Beijing Jiaotong University, Beijing, 100044, P.R. China

<sup>2</sup>MOE Key Laboratory for Urban Transportation Complex Systems Theory and Technology, Beijing Jiaotong University, Beijing, 100044, P.R. China

**Abstract:** With the promotion of “Internet + efficient logistics” and refer Tomorrow’s Elastic Mobility Adaptive (TEAM), this paper extends the framework of urban logistics based on the Internet and cloud computing environment, specifies the challenges and transitions experienced by the commodity market, transport market, infrastructure market, then discusses several key technologies of IT application in urban freight transportation including dynamic regulation of the transport market for administrator, “last mile” solutions, coding system and green vehicles. Now IT building blocks of digitally free open source software not only provide the IT infrastructure but also facilitate “Share more – Develop less” for mass innovation convenience of cities. It no doubts that an efficient, environmentally friendly and intelligent urban freight system will come true in the near future.

Keywords: urban logistics, Internet, cloud computing

## 1. INTRODUCTION

Learn from Tomorrow’s Elastic Adaptive Mobility (TEAM, <http://www.collaborative-team.eu/>), which turns static into elastic mobility by joining drivers, travellers and infrastructure operators together into one collaborative network. Here extend urban logistics framework integrated Internet and cloud environment and specified the challenges and transitions experienced by the commodity market, transport market, infrastructure market. As a result, supply side reform is urgent, especially the mind-set change of administrators. IT building blocks of digitally free open source software not only provide the IT infrastructure but also facilitate “Share more – Develop less” for mass innovation convenience of cities. Here discussed some key technologies of operation, including dynamic regulation of the transport market for administrator, “last mile” solutions, coding system and green vehicles, whether purely electric, plug-in or hybrid for delivery.

## 2. CITY LOGISTICS FRAMEWORK EXTENDED

### 2.1 Connotation and denotation of city logistics

Cities are based on a number of different systems (infrastructures, networks and environments) vital to their operation and development. The effectiveness and efficiency of these systems determines how a city works and how successful it is at delivering its goals<sup>[1]</sup>. The institute of city logistics (Taniguchi as president) defines city logistics as “the process for totally optimizing the logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy.”<sup>[2]</sup> Figure 1. extended urban logistics framework integrated Internet and cloud environment<sup>[3]</sup>, in view of the social and economic environment of China.

These policy leverages, together with partnership building with logistics and transport operators, are the necessary ingredients to create a tailored solution for more efficient urban freight transport management([www.sugarlogistics.eu](http://www.sugarlogistics.eu)). Technical, legal and social factors all should be considered.<sup>[4]</sup> Cities have

\* Corresponding author. Email: [xxwang@bjtu.edu.cn](mailto:xxwang@bjtu.edu.cn) (Xiaoxia Wang)

limited resources and they must take account of the interconnected challenges and the interrelated systems they influence. In a particular single case, it is always a “trade-off” problem in choosing the most important system to concentrate at the moment. And presented systems are connected and influencing each other. Therefore, they require from the city administration, the ability to predict the holistic impact of decision effects taken in a single area of the chosen system. They also require intelligent management in different layers of cities’ activities. [5]

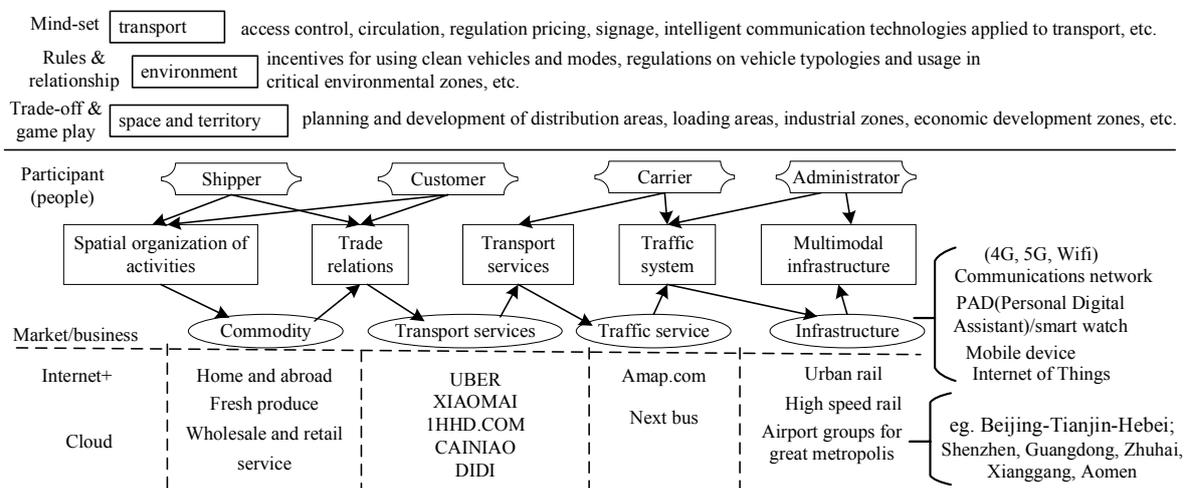


Figure 1. Extended urban freight framework domain

### 2.1.1 Commodity market (“Internet + cross-border trade”)

The combination of online and offline of retail business, open up international markets, develop cross-border e-tailing. For example, Alibaba.com, Global trade starts hers<sup>TM</sup>, launched in 1999, a platform for global wholesale trade, manufacturers, suppliers, exporters & importers from the world’s largest online B2B marketplace. Another example AliExpress, Smarter Shopping, Better Living. Or cross-border e-commerce experimental region for comprehensive development of Hangzhou, which will further expand the pilot. And Pilot Free Trade Zone are thriving in China since 2015, including Guangdong(Guangzhou Nansha, Shenzhen Shekou, Zhuhai Hengqin),Tianjin Binhai CBD(Central Business District) area, Fujian and Shanghai.

Promoting the construction of large circulation network and regional market integration. For example, the Beijing-Tianjin-Hebei Regional Integrated and Coordinated Development Strategy has been accelerating, which play a fundamental influence and role on the concept of the urban and rural logistics system for the capital economic circle. To promote the coordinated development of Beijing-Tianjin-Hebei circulation industry, overall planning the construction of circulation facilities based on these areas for co-construction and sharing. The non-capital functions of Beijing are moving out orderly, e.g. the wholesale markets transferred, including the Zoo area, Dahongmen area, Tianyi commodity market, Xizhihe stone market and Xinfadi wholesale market, the government administrative service organizations move out(promoting Tongzhou district as city administrative sub-center).

Large retail enterprises start online shopping mall, and actively use the mobile Internet, location-based services, big data and other information technology to enhance the efficiency and quality of circulation. For instance, Tmall of Ali group as B2C have more and more flagship stores and brand stores. To change the mode of operation, physical stores, suffering the impact of the online mode, adjust and restructure, e.g. upgrading the proportion of own-running goods, increasing the proportion of self-owned brands, customized products, in-depth development of chain operations. For instance, JD.com, leading self-support e-commerce enterprise of China; Suning.com enhanced virtual networks with physical stores. Physical stores have digital transformation

via Internet technology, enhanced functions like scenarios, stereoscopic and intelligent display, perform a full channel marketing. Constantly to enrich consumers' experience, transitions to the intelligent, diversified commercial services, increase catering, leisure, entertainment, cultural and other facilities, from the sale of goods solely to "goods + services" equal. Small and medium sized entities should play the advantages of close to consumers, improve the convenience of the service system, provide additional convenience services like fast food, fee payment (even internet finance, take ANT Financial as an example Figure 2), network ordering shop take, community distribution etc. Internet companies and the physical stores strengthen the integration and cooperation, take both the advantages of online interaction, guiding and gathering customer, precise marketing and offline real experience, brand reputation, logistics and distribution, flattening organizational management, intelligent facilities, online of the commercial subject, digitization of business object and standardization of operation service. New agricultural business entities docking electronic business platform, effectively connect the information of product and demand, promote the integration and development of online marketing and offline circulation of agricultural products. Agricultural production materials distribution enterprises develop e-commerce and e-marketing.

**ANT CHECK LATER**, kind of credit account based on Zhima credit  
**Alipay** is a real name and trust-based one-stop scene platform dedicated to meet the needs of users in different scenarios, such as consuming, financial planning, urban life, communication and so on, with the way of people-centered. Also they are vigorously developing various offline scenarios, including taxis, public transport, supermarkets, convenience stores, restaurants and etc.  
**Zhima Credit** is a socially oriented credit service system that based on all aspects of information, apply big data and cloud computing technology to objectively present personal credit and let everyone experience the value brought by credit via connecting a variety of services.  
**ANTDAQ** is committed to equity investment—Internet equity financing platform for enterprises and entrepreneurs.  
**ANT Micro Loan** provides micro finance services to small and micro enterprises and individual entrepreneurs of E-commerce via Internet, bulk and data  
**Mybank.cn**  
**Yu'eobao**, for shopping, transfers, repayments, prepaid recharge, etc.  
**Zhaocaiobao** is the open platform of investment and financial management, open for authority of financial institutions, provides convenient and secure Internet Financial services to the small and medium-sized investors, as well as high efficient and low cost Internet Financial services to small and medium-sized enterprises and individuals.  
*Ant financial cloud is cloud computing service that helps enterprises to quickly build with IT systems meet with the financial industry standard*

**Figure 2. Internet finance take Ant Financial as an example to illustrate**

Trading market of traditional commodity strengthen trading matchmaking, commodity distribution, price discovery, information interaction and other traditional functions via the Internet, enhance logistics and distribution, quality standards, financial services, design and development, exhibition display, consulting services and other new functions as well. Traditional wholesale enterprises build collaboration platform of supply chain via Internet technology, extended to the segment of manufacture and retailing, to achieve the transformation of the supply chain management services. The development of the brand alliance or building a joint procurement platform for brands, gathering brand resources and reducing the cost of procurement. Deepen the use of e-commerce, boost commodity trading markets transit to e-commerce parks, logistics parks. E-commerce and modern logistics as the core, promote the optimizing of resource allocation of the commodity trading market, improve the efficiency of circulation. The transformation of the online industry information services platform to the integrated trading service platform, to organize the offline exhibitions, fairs, trade fairs for the customer needs, to provide a full range, vertical and in-depth services for the development of the industry.

As a consequence, traditional demand forecasting like commodity-based models, trip-based models and tour-based models should be modified accordingly. Recently, it a good choice to include logistics or supply chain elements into freight modelling (typically simulates commodity flows in an urban area within the framework of supply chain management. Locations of manufacturers, distributors and consumers are considered, like all kinds of Vehicle Routing Problem(VRP) and solutions <sup>[6][7]</sup> refer Figure 5, or specify the trend of green VRP <sup>[8][9][10]</sup>.

### 2.1.2 Transport market

Formerly, there are no practical cargo public transport systems available for freight. Cities' administration has to rely on trucks and vans for urban distribution supported in most of the cases by logistics providers from the private sector.<sup>[5]</sup> Joint Delivery Systems, e.g. [www.motomachi.or.jp](http://www.motomachi.or.jp), is a candidate. However, with internet this kind freight delivery became available, e.g. Good express (<http://www.2175566.com/>) of Rizhao city of Shandong Province of China. Another example, XIAOMAI (<http://www.imxiaomai.com/>) integrated O2O(Online 2 Offline) service platform for campus. May 28, 2013, jointly announced that China smart Logistic Network project was officially launched, the CAINIAO Network Technology Co., Ltd. was formally established which is formed by Alibaba group, SF group, Shentong, Yuantong, Zhongtong, Yunda, ZJS, Huitong etc. The advantage of CAINIAO is the data, not only data of customers, businesses and consumer, and also logistics information routing data. With these data, CAINIAO's work is the aggregation of logistics orders.

For the regulatory of emerging service on the Internet, innovate the mode and technology. Reform idea is to insert the "special car" (through the new network and car booking) to promote the reform of traditional taxi(refer to Table 1), differential operation to form the integration and development of cruising taxis and car reservation. "Increments drive the reform of stock, market segmentation improves transport service"; the transformation and upgrading of traditional taxi. Breaking the monopoly of the license, loose the control over market entry.

**Table 1. The reform of taxis market regulation in some areas**

| Areas    | Policy   |
|----------|--|
| Hangzhou | Guiding Opinions for Deepening the Reform of Hangzhou Taxi Industry (Dec. 2, 2015) "Uncompensated Usage of Managerial Authority"; "Application for Clearance & Regulation", also referred as "Confirming Rights" |
| Ningbo   | Since Jan. 1, 2016, Ningbo remove use fees of operating rights of taxi, reduce the burden of RMB 800 yuan per vehicle per month.   |
| Jiangsu  | Since Jan. 1, 2016, Jiangsu remove the fee of management service, lease and contract fee after Guangzhou and other cities.   |
| Nanjing  | downgraded the lease and contract fee with different degrees since April 1, 2015.  |
| Yiwu     | to open market access of taxi by 2018, no longer control the number of taxis, etc.   |

Meanwhile, collective intelligence and social media have been major drivers of the spatial intelligence of cities and they can be used by a crowdsourcing tool to examine the demand for transport. The other way to measure traffic and plan transportation (and others, like commercial) activities within the urban spatial area is analyzing the density of mobile usage within different areas of the city.<sup>[5]</sup> Crowdsourcing in daily services like travel, no-car carrier logistics, express delivery, matching supply and demand information efficiently with Internet technology, optimize organization and operation mode of the customary life service industry. New service model of share economy of the integration and utilization of decentralized idle social resources. Expand service network consumption via community service.

### 2.1.3 Infrastructure market

Intermodal freight transport in urban areas especially for metropolis, like urban logistics by rail and waterways in France and Japan<sup>[11]</sup> or cityporto logistics scheme like Interporto Padova(<http://www.interportopd.it/en/>). In Dec., the Beijing-Tianjin-Hebei issued joint development of integrated transport planning to build rail transit of skeleton as "four longitudinal and four transverse and one ring" and harmonized vehicle emission standards. Now officially operate the railway between Tianjin and

Baoding, thus Tianjin railway station shares some traffic to Beijing. As for airports, Beijing-Tianjin-Hebei now have Beijing international airport (in Northeast of Beijing), Nanyuan Airport (in South of Beijing), Tianjin international airport and Baoding international airport (Hebei province), which connected by high speed rail(via urban rail transit) or airport shuttles.

Future internet technologies with instrumentation and interconnection of mobile devices and sensors can collect and analyze municipal data in real time, improve the ability to forecast and manage urban flows. Then, it is worth considering the technology drivers of embedded spatial intelligence, the new e-services that can be created in cities and the governance of innovation ecosystems within smart environments embedded in the urban space<sup>[12], [5]</sup>

## 2.2 Policy targets for administrator to regulate traffic flow of urban area

Some European projects on green urban freight transport management list as Table 2<sup>[13]</sup>, adaptative ecological approaches to implementing good practices to support environmentally friendly<sup>[14]</sup>.

**Table 2. European projects for smart and sustainable city logistics**

| Projects            | Web site               | Brief introduction  | Period                         |
|---------------------|------------------------|---|--------------------------------|
| BESTUFS/BE STUFS II | www.Bestufs.net        | to maintain and expand an open European network between urban freight transport experts, user groups/associations, ongoing projects, the relevant European Commission Directorates and representatives of national, regional and local transport administrations and transport operators in order to identify, describe and disseminate best practices, success criteria and bottlenecks with respect to City Logistics Solutions (CLS) | 2000-2008                      |
| TRAILBLAZER         | www.trail-blazer.eu    | aims to promote Delivery and Servicing Plans (DSPs) across Europe. Reducing energy use in urban freight transport; TRansport And Innovation Logistics By Local Authorities with a Zest for Efficiency and Realisation   | 36 months until 30th June 2013 |
| START               | www.start-project.eu   | Seamless Travel across the Atlantic area Regions using sustainable Transport (START for short)  | 2009-2013                      |
| SUGAR               | www.sugar-logistics.eu | focuses on addressing the problem of inefficient and ineffective management of urban freight distribution; Sustainable Urban Goods Logistics Achieved by Regional and Local Policies  | 2007-2013                      |
| C-LIEGE             | www.c-liege.eu         | Clean last mile transport and logistics management  | 30 months, 2014                |
| CITYLOG             | www.city-log.eu        | Sustainable and efficiency of city logistics  | started on Jan. 1, 2010        |
| TURBOLOG            | www.tur-blog.eu        | addressing urban logistics from a wider (geographical) perspective, focusing upon a worldwide level (in general) and on Brazil and Peru (in particular)   |                                |
| CIVITAS             | civitas.eu             | namely City, Vitality and Sustainability  | Until 2016                     |
| ENCLOSE             | www.enclosure.eu       | Energy efficiency in City Logistics Services for small and mid-sized European Historic Towns  | 2012-2014                      |

Objective to reduce environmental externalities is generally tackled by administrator who is responsible for habitable urban areas. Policy perspective is utilized to test measures such as congestion charging and vehicle restrictions, <sup>[3] [10]</sup> received and tracing of goods in the e-commerce environment. City logistics policies are

required to provide better services at lower costs for customers as well as reducing negative environmental impacts and improving safety. “Higher load factors” and “best fuel technology” for network modelling. To create more efficient and environmentally friendly urban freight transport systems, a change in the mind-set of logistics managers is critical for city logistics [2] as Figure 3.

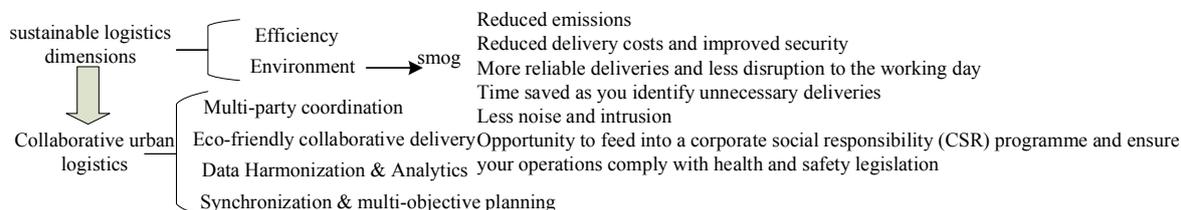


Figure 3. Ecological-greening in collaborative urban logistics<sup>[7]</sup>

**2.3 IT building blocks of digitally enabled cities(facilitate convenience)**

With the application of innovative technologies of ICT(Information and Communication Technology) and ITS (Intelligent Transport Systems), IT building blocks of digitally free open source software, as Figure 4, not only provide the IT infrastructure but also facilitate “Share more – Develop less” for mass innovation convenience of cities. Gives unique opportunity to design city logistics infrastructure in the way that it is easily adaptive to changing transport demands; the concept of citizens’ demand-driven flexible logistics infrastructure performance for the sustainable city of the future [5].

|   |  |  |  |
|---|--|--|--|
| Web 3.0 & Social networking<br>Interactivity  |  |  |  |
| Advanced analytics<br>Fact-based decisions  |  | Open access to public data<br>Many eyes          |  |
| Open standards, SOA(Service-Oriented Architecture), and ecosystems IT assembly(open access) |  | Digitally controlled devices<br>Realtime control |  |
| Geospatial platforms<br>Place-based data  |  | Internet of Things<br>Realtime data              |  |
| Ubiquitous connectivity<br>Always on(5G,4G,WIFI)  |  | Anytime/anyplace devices<br>Convenience          |  |
| Collaboration Platforms<br>Teamwork(open source)  |  | Cloud computing<br>IT as a service               |  |

Figure 4. IT building blocks<sup>[5]</sup> revised

**3. KEY TECHNOLOGY OF OPERATION REGULATION**

To increase the use of delivery areas by prior booking by professional delivery operators<sup>[15]</sup>, and make dynamic adjustment of their booking, if necessary. Information technologies with mobile communicating devices and in-roadway sensors are used in front of the information management process system. Different kinds of cooperation as dynamic sharing between delivery areas and private vehicles parking areas; as cooperation of delivery by their consolidation by appointment of delivery companies by geographical area and by specific solution for last kilometer delivery (for instance by bicycle). A solution based on distributed negotiation between multi-agents representing the delivery operators as Figure 5<sup>[7] [13] [15] [16]</sup>, empowers a cooperative approach between public and private stakeholders that is targeted on the reduction of energetic and environmental impacts of freight transport in urban area, which promote cleaner and energy efficient freight movements in urban areas, with a novel set of integrated solutions and “push-and-pull” demand-oriented measures.

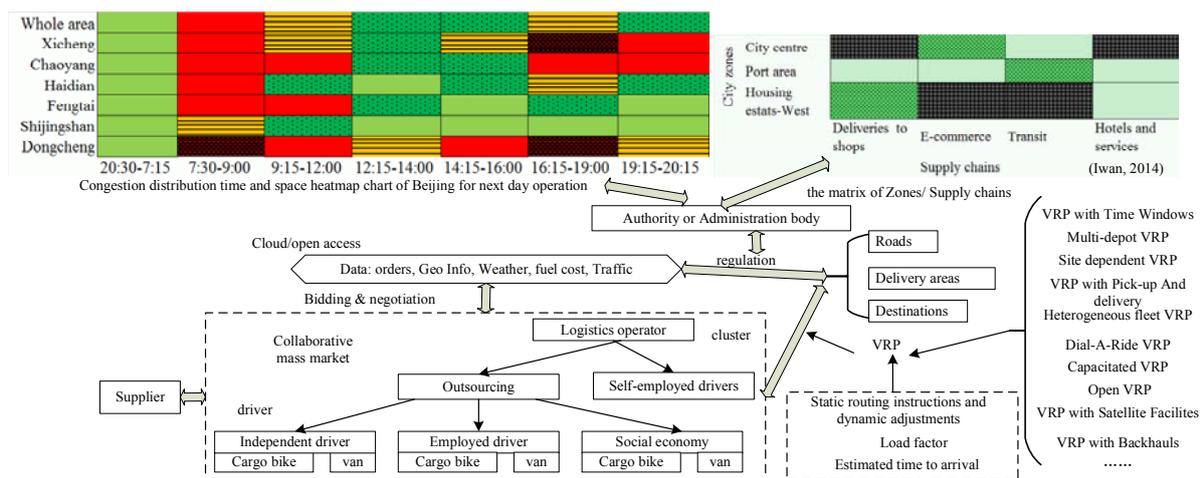


Figure 5. Information framework of collaborative urban logistics concept

The pragmatic coordination of the “Last Mile” (or Last Kilometre” or “First Mile” in the case of collections and/or returns is a little addressed but is a common logistics collection/distribution problem in built-up (urban) environments, particularly in Asia (or more specifically ASEAN, namely Association of South East Asian Nations, or even for that matter in Singapore). [7] “E-market” pools to synchronize the last mile and achieve collaborative urban logistics, like the use of bicycle messengers in the logistics chain [16]. For some instance, Cyclocargo(<http://www.cyclocargo.ch/>), a French cargo bicycle, carry up to 250kg without losing the advantages of biking in the city; the Belgian bike messenger company Pedal BXL(<http://www.pedalbxl.com/>) or Lunchbutler.be(<http://www.lunch.be/>). Coding system is a transferable benchmark in urban logistics, Figure 6(a) Mumbai (India) lunch box delivery system home to work by dabbawalas for the illiteracy [17], Figure 6(b) CAINIAO electronic express bill, apply for 15 main stream express companies once, no need to dock with each of them within Tmall.

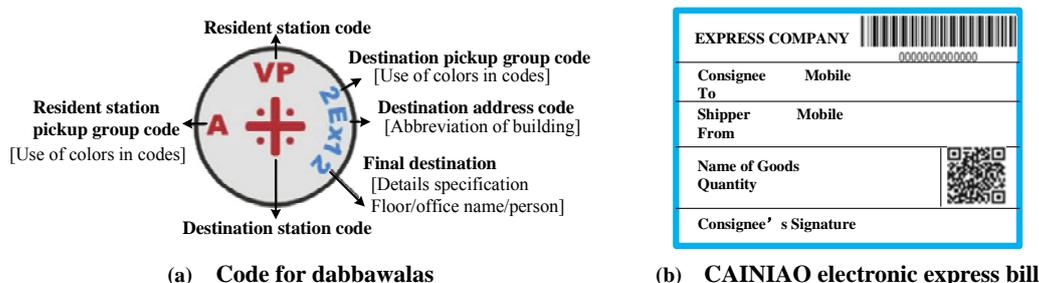


Figure 6. Coding system

#### 4. CONCLUSIONS

Under the “Internet +” strategy and with cloud computing, the activities of business transactions and service are undergoing tremendous change, along with the new relationships and rules. First, portable intelligent hardware innovation makes it easier and cheaper to connect everything. For instance, PDA (Personal Digital Assistant) -based solution used on the spot appeared to be much more cost-effective than the camera recognition. Interoperable IT system usage based on cloud computing model facilitating future smart city logistics development. With online and offline interoperation, combined with the synchronous development of policy-driven about regional integration and cross-border e-tailing, as well as green vehicles, whether purely

electric, plug-in or hybrid for delivery or vokoli cargocycle in “the last kilometer” distribution synergies, ultimately, we can optimize the resource allocation, save the whole supply chain operating costs, improve efficiency and quality of the whole industry chain enterprises. It no doubts that we will build an efficient, environmentally friendly and intelligent urban freight system.

## ACKNOWLEDGEMENT

This work was supported by NSFC (Project: 71303018), Center of Cooperative Innovation for Beijing Metropolitan Transportation.

## REFERENCES

- [1] Dirks, S., Keeling, M. (2009). A vision of smarter cities. New York: IBM Global Services, 18.
- [2] Taniguchi, E. (2014). Concepts of City Logistics for Sustainable and Liveable Cities. *Procedia - Social and Behavioral Sciences*, 151, 310–317.
- [3] Anand, N., Quak, H., van Duin, R., Tavasszy, L. (2012). City Logistics Modeling Efforts: Trends and Gaps - A Review. *Procedia - Social and Behavioral Sciences*, 39, 101–115.
- [4] Foltyński, M. (2014). Electric Fleets in Urban Logistics. *Procedia - Social and Behavioral Sciences*, 151, 48–59.
- [5] Nowicka, K. (2014). Smart City Logistics on Cloud Computing Model. *Procedia - Social and Behavioral Sciences*, 151, 266–281.
- [6] Lin, C., Choy, K. L., Ho, G. T. S., Chung, S. H., Lam, H. Y. (2014). Survey of Green Vehicle Routing Problem: Past and future trends. *Expert Systems with Applications*, 41(4), 1118–1138.
- [7] de Souza, R., Goh, M., Lau, H.-C., Ng, W.-S., Tan, P.-S. (2014). Collaborative Urban Logistics – Synchronizing the Last Mile a Singapore Research Perspective. *Procedia - Social and Behavioral Sciences*, 125, 422–431.
- [8] Jovanović, A. D., Pamučar, D. S., Pejčić-Tarle, S. (2014). Green vehicle routing in urban zones – A neuro-fuzzy approach. *Expert Systems with Applications*, 41(7), 3189–3203.
- [9] Čirović, G., Pamučar, D., Božanić, D. (2014). Green logistic vehicle routing problem: Routing light delivery vehicles in urban areas using a neuro-fuzzy model. *Expert Systems with Applications*, 41, 4245–4258.
- [10] Taniguchi, E., Thompson, R. G., Yamada, T. (2014). Recent Trends and Innovations in Modelling City Logistics. *Procedia - Social and Behavioral Sciences*, 125, 4–14.
- [11] Diziain, D., Taniguchi, E., Dablanc, L. (2014). Urban Logistics by Rail and Waterways in France and Japan. *Procedia - Social and Behavioral Sciences*, 125, 159–170.
- [12] Komninos, N., Pallot, M., Schaffers, H. (2013). Special Issue on Smart Cities and the Future Internet in Europe. *Journal of the Knowledge Economy*, 4(2), 119–134.
- [13] Iwan, S. (2014). Adaptative Approach to Implementing Good Practices to Support Environmentally Friendly Urban Freight Transport Management. *Procedia - Social and Behavioral Sciences*, 151, 70–86.
- [14] Pulawska, S., Starowicz, W. (2014). Ecological Urban Logistics in the Historical Centers of Cities. *Procedia - Social and Behavioral Sciences*, 151, 282–294.
- [15] Patier, D., David, B., Chalon, R., Deslandres, V. (2014). A New Concept for Urban Logistics Delivery Area Booking. *Procedia - Social and Behavioral Sciences*, 125, 99–110.
- [16] Maes, J., Vanelslander, T. (2012). The Use of Bicycle Messengers in the Logistics Chain, Concepts Further Revised. *Procedia - Social and Behavioral Sciences*, 39, 409–423.
- [17] Baidur, D., Macário, R. M. (2013). Mumbai lunch box delivery system: A transferable benchmark in urban logistics? *Research in Transportation Economics*, 38(1), 110–121.