# An Experimental Study on Cooperative Parcel Pick-up System Using the Internet

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## 1. Introduction

In Japan, commercial transactions through the internet between individuals and companies, and among companies, have intensified since cheap high-capacity communication began to spread. These transactions have directly impacted the form of distribution by increasing the frequency of small-lot deliveries from upstream business to downstream business (or from producer to final consumer, in the extreme case). As a result, the number of cases of parcel delivery companies responsible for moving the goods has been increasing.

Although parcel delivery companies are efficient in practicing full-load transport of large trucks between cities, the delivery and pick-up of cargo within the city is relatively inefficient, thus causing traffic congestion. In particular, a number of small trucks park on the roadside during delivery in the commercial business districts because several building establishments do not have an underground parking space wherein delivery trucks can load and unload their goods, or because the amount of shipment may be so few that parking off the road is a troublesome thing to do. Pick-up of parcels is also inefficient. In the central business district where a lot of door-to-door transport is generated, there are cases when small trucks used for pick-up wait on the roadside so that they can immediately respond to unexpected requests from shippers.

To improve the above situation, the Ministry of Land, Infrastructure and Transport conducted an experiment in Otemachi, Tokyo in 2002. A committee composed of shippers in the Otemachi district, logistics service providers, and government officials was organized to take care of its planning and implementation. In this experiment, transport requests by shippers are made easily through the use of internet (shipper's merit), and an appropriate logistics service provider collects the bundled transport demand for each building, thus increasing transport efficiency (carrier’s merit) and reducing roadside parking and truck traffic in terms of vehicle-kilometers resulting in less congestion and environmental burdens (social merit).

The objective of this paper is to clarify the following: a) the principles of the experiment based on the review of E-logistics, b) the detailed system design carried out by the committee for its implementation, and c) the results of the experiment and future tasks concerning cooperative parcel pick-up system using the internet. The paper will then try to present conclusions.

## 2. E-Logistics and Experimental Design

The mechanism that matches the shipper's demand and the logistics service provider's supply through the internet has been in existence and is termed as "E-logistics". The existing structure of E-logistics was first examined to understand important concerns that shippers and logistics service providers might have.

### 2.1 The model of E-logistics

There are four types of business models for E-logistics as shown in Figure 1.

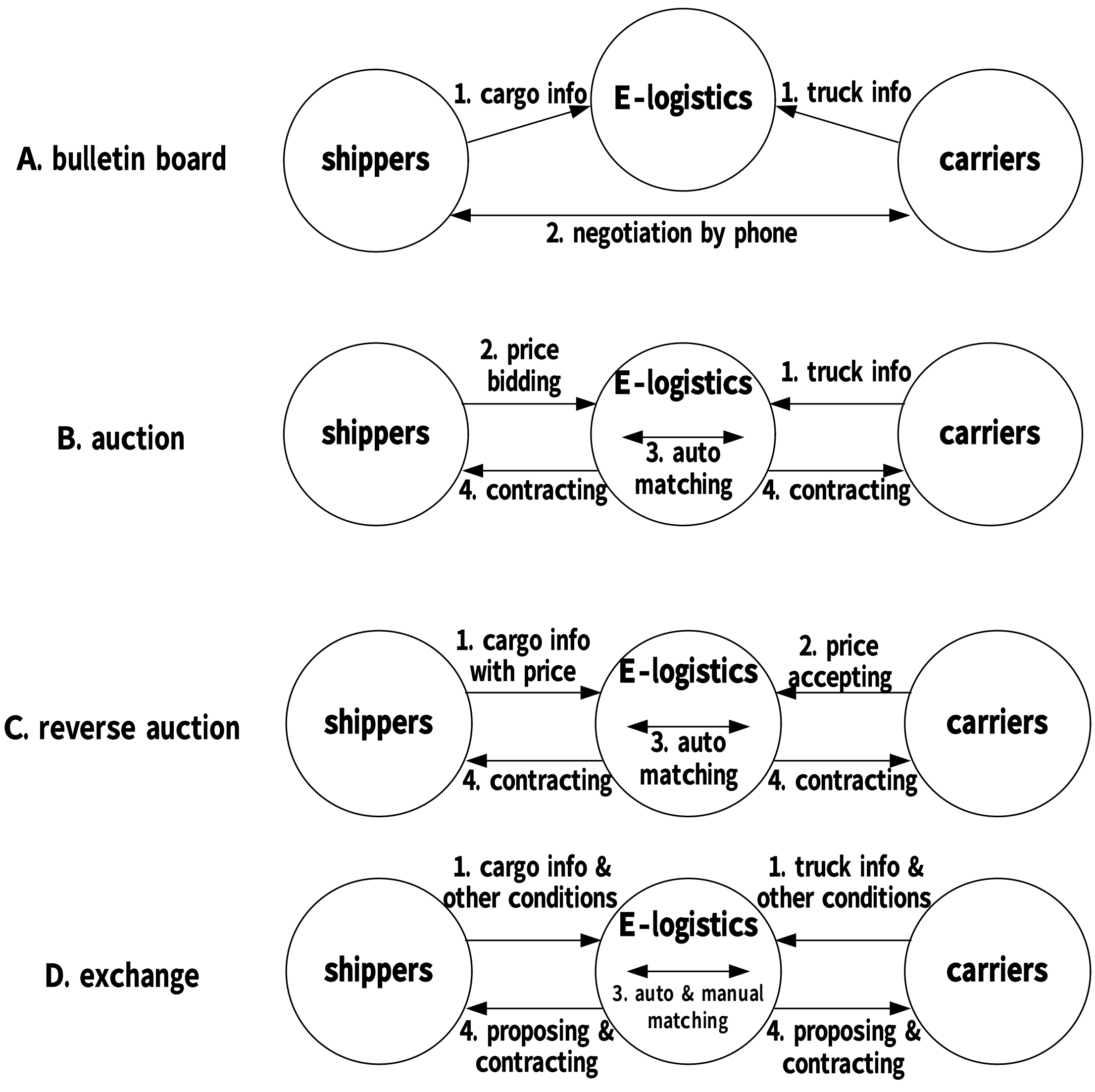


Figure 1 Business models for E-logistics
References: Krishnamurthy (2003), Daiwa Research (2001)

Type A is the bulletin board type wherein shippers and carriers (or logistics service providers) freely input cargo information and empty truck information. After checking the bulletin board, interested shippers and carriers negotiate separately by telephone the various contract terms, including freight charges. This set-up allows some website administrators to charge commissions from the shippers and carriers while others profit from other means. The former involves charging of a fixed commission after both parties have agreed on the service contract, for example 5% for freight liquidation and insurance. The latter enables websites to earn income through banner advertising and from utilizing the site for manpower staffing and selling of office equipment.

Type B is the auction type wherein empty truck information registered by the carriers is offered for bidding to several shippers. The highest bidder will then get the contract for the logistics service offered. It is difficult to actualize this because it needs to involve a certain number of potential buyers requiring the same conditions to join the bid. Said conditions not only include the trip origin and destination but also the time for the transport service and the type of vehicle.

Type C is the reverse-auction type wherein the cargo information and the desired price for the service are registered by the shippers. The contract is then awarded to the carrier who first accepted the price and signified intention to perform the service. As in Type B, this concept is also difficult to actualize because it requires a certain number of potential sellers having similar requirements to join the bid before automatic matching is attained.

Type D is the exchange type wherein sellers and buyers, who simultaneously share information and conditions, search for their appropriate partners. Automatic matching is first utilized to reduce the number of candidates who satisfy the basic conditions. Then these conditions are subsequently adjusted manually. A good example, which can be regarded as successful, is the site by NTE Inc. (formerly the National Transportation Exchange), a non-asset third party logistics provider. The company is responsible for the determination of freight charges and other payment matters.

As pointed out by Hayashi (2002) that even in the US, the slowdown in the progress of IT caused the recent economic recession and therefore IT’s serviceability is being reassessed in the field of logistics. Even the excitement brought about by the logistics e-market place (E-logistics), such as trade exchange using the internet and truck and cargo matching systems, also experienced decline and is likewise being reassessed.

### 2.2 Internet truck and cargo matching system

From the point of view of business, there are only few successful E-logistics websites in Japan. Some are successful in getting a number of contracts, however, including those who only use the internet to arrange payment of freight charges and facilitate documents for insurance. The case is, in fact, an example of Type A where actual matching is performed by telephone.

Misui (2002) pointed out that there were almost 50 entities that employed the internet truck and cargo matching system from its inception by Japan Digicom, Inc. at the end of 1996. These entities not only include logistics service providers but also other companies, such as shippers, information system companies, trading companies, and business ventures. Later, however, several companies, including the Japan Digicom, Inc., announced withdrawal from business or shutdown of operations in their truck and cargo matching systems.

In order to identify the reasons why E-logistics is quite unpopular in Japan, Japan's transport industry, in general, and the truck and cargo matching system, in particular, will be looked into.

First it must be recognized that majority of the logistics service providers are also the shipper or the client (in over 70% of the freight contracts). This means that there exist two or three hierarchical structures in Japan, the so-called principal contractor, the subcontractor, and the sub-subcontractor. Though brokerage fees are added in the middle stages, a specific function is carried out. From the viewpoint of the shipper, for example, they experience difficulty in requesting service from a logistics service provider in the area where the cargo is to be delivered. It could be convenient if they collectively commission all cargo to a credible logistics service provider associated with them. This concept is the so-called "one-stop services" for shippers or "third party logistics" for logistics companies who subcontract the services.

The relationship between the principal contractor and the subcontractor is, in a sense, economically justifiable. Subcontractors could be set-up even if the freight charges are somewhat cheap, as long as a fixed amount of cargo is maintained without much marketing efforts. Even if the principal contractors get the brokerage fee without doing actual transportation, they bear the burden of risk of being the guarantor not only for the operating expenses but also for the quality of work of the subcontractor. The relationship between the principal contractor and the subcontractor is maintained by keeping this delicate balance. The truck and cargo matching system using the telephone in Japan thus evolved to become a mechanism facilitating mutual requests of transport services among logistics service providers.

The question is whether the internet truck and cargo matching system affects the conventional structure of contracting services. Unfortunately the answer has been 'No', resulting in unpopularity of E-logistics so far at least.

The principal contractor has a chance to consider it an opportunity to meet cheaper subcontractors, while the subcontractor has a chance to use it as an opportunity to meet principal contractors who are willing to pay higher freight charges. There are, however, risks involved in both cases. The principal contractor is afraid of failure to deliver service when the cargo is entrusted to an unknown logistics service provider with cheap freight charges. The subcontractor is afraid of failure to receive the right amount of payment contracted for freight charges. It is difficult to reduce systematically the risks involved in truck and cargo matching systems, which were dealt with mainly on conventional human relations in the past.

Risks must be mitigated as much as possible so that the internet system becomes attractive. To cite an example, several websites adopt a membership system that only allows participants who could fulfill the required qualifications.

Furthermore we should raise another question whether the internet matching system involving the shippers directly is effective, which is not common yet in Japan. If shippers can directly join the bidding process, the more desirable solution could be obtained by increasing the flexibility of finding appropriate shipper-carrier combination making efficient configuration of transport, consolidation (de-consolidation) and storage. Though it is convenient for the shippers to request service from the same carrier regardless of the cargo destination, the logistics chain might be sub-optimized because of the constraints concerning transport, consolidation and storage they or their affiliated subcontractors have.

Risk management is more important in the shipper-participating internet matching system than the inter-carrier matching system, because shippers (carriers) have not experienced business with many carriers (shippers) and they do not know each other well.

One way to reduce risk is to identify the client as credible shippers in a particular district, and at the same time to carefully choose credible carriers that have been doing business there, thus creating a virtual business community. Though the limited membership in a particular area can become a preventing factor for the efficient implementation given the limited extent of matching, this disadvantage might be outweighed by the advantage of direct shipper participation. In the experiment, a virtual business community is intended to take form.

It is notable that the experimental system has a weak point because the target of matching is not freight transport characterized as ‘inter-urban Full Truck Load (FTL)’ which is common in the existing market, but ‘urban Less-than-Truck Load (LTL)’. When matching truck and cargo of inter-urban FTL, they are in a hurry in order to get a better business opportunity. Depending on the transport demand, the carriers may offer lower freight rates to prevent their trucks from going back without any backhaul. The internet system enables them to check their partners in a short period of time. However, when matching truck and cargo of urban LTL, they have less incentive to offer lower/higher freight rates in real time, even though in the long term they are making every effort to raise the volume of parcels in order to enjoy scale economy in the production of urban LTL transport.

Finally, it is concerned that the participation of shippers in the bidding process would disable carriers from setting a high price based on the buyers’ willingness-to-pay due to the disclosure of price information. It must be noted, however, that price information is becoming more common knowledge by the internet, and that only carriers with strong competitiveness can survive in this age.

### 2.3 Principles of the experiment

The experiment was conducted in front of the JR Tokyo station in Otemachi, a commercial business district where rent is very high and only companies of good standing are occupants. Ninety-nine buildings are erected within the 110-hectare area. A major real estate firm has control of the majority of the buildings inside the district. The tenant companies, as members of the District Redevelopment Project Council for Otemachi, Marunochi, and Yurakucho (www.lares.dti.ne.jp/%7Etcc/index.html), develop a joint project for the area. The Council’s project involves the establishment of a cooperative parcel pick-up system in their website. The shippers in the area are those with good credibility.

Carriers doing parcel delivery business in the same district were invited to collaborate on the experiment. Carriers that agreed to cooperate were registered. The matching process, through the internet, was planned with the objective of seeking the most optimal combination of providing cheap services from the viewpoint of the shipper, allowing efficient pick-up from the viewpoint of the carrier, and reducing environmental externalities for the society.

## 3. Detailed Design of the Cooperative Parcel Pick-up System

The detailed system design was entrusted to an exploratory committee composed of representatives from the shippers, the carriers and governmental officials, chaired by me. Several problems identified during the process of discussions caused the first draft of the plan to undergo considerable revisions (Table 1).

Table 1 Comparison of original plan and implemented system

| | Original plan | Implemented system |
|---|---|---|
| Matching | Automatic matching by price and other conditions | Transmitting pick-up requests to fixed pre-contracted carriers |
| Bundling | Bundling of different carriers' orders | Bundling the same carriers' orders with less frequent pick-up |
| Invoice | Standardized invoice | Individual invoice attached additionally |
| Communication | Internet | Internet, EDI and fax |

One of the major problems identified was the issue of automatic matching. As earlier mentioned, the matching process through the internet was to seek the most desirable combination of providing cheap services, allowing efficient pick-up, and reducing environmental externalities. Then the inclusion of freight charges as a factor in the matching process was proposed. This, however, received strong opposition from the carriers because the plan may lead to increased price cut competition, which forced the committee to revise the original plan.

Although the common household is charged a flat rate for the parcel delivery service, the freight rate of business shipment is negotiated according to the number of transactions in a month and other requirements. Evidently the shippers have the advantage of using the website in finding carriers that offer cheaper freight rates. However the carriers already doing business in the area insisted that the use of the website does not warrant better business performance (e.g. winning new shippers). As a result, it was decided that the setting of freight charges between shippers and carriers would not be dependent on the experimental system.

Even if each shipper requests different carriers for the pick-up service, it is possible that a particular carrier could perform the actual collection work jointly in a particular area. Unfortunately, however, the carriers opposed to the method of joint collection. They stressed that the collection must be of the same carrier because the collection gives a good opportunity for their sales drivers to find additional business chances. As a compromise, it was resolved that pick-up efforts shall be made by the same carriers and shall follow a system in which for one day, a total of three pick-up times (11:30, 14:30, and 18:00) is designated, and not a system in which carriers enjoy the freedom to collect any time they wish.

There was also the issue of standardizing the invoice forms. The standardized invoice was not enough to reflect the differentiated services of the carriers so that separate invoices of some carriers had to be attached to the standardized invoice forms. Examples of differentiated services offered by the carriers include a service that enable shippers to validate the computerized signature of the accepting person and a record of guarantee of up to 300,000 yen, among others.

Furthermore, although a standard system for internet communication was preferred, it was decided that ordinary EDI and FAX were also to be used because of the large investment involved and short duration of the experiment.

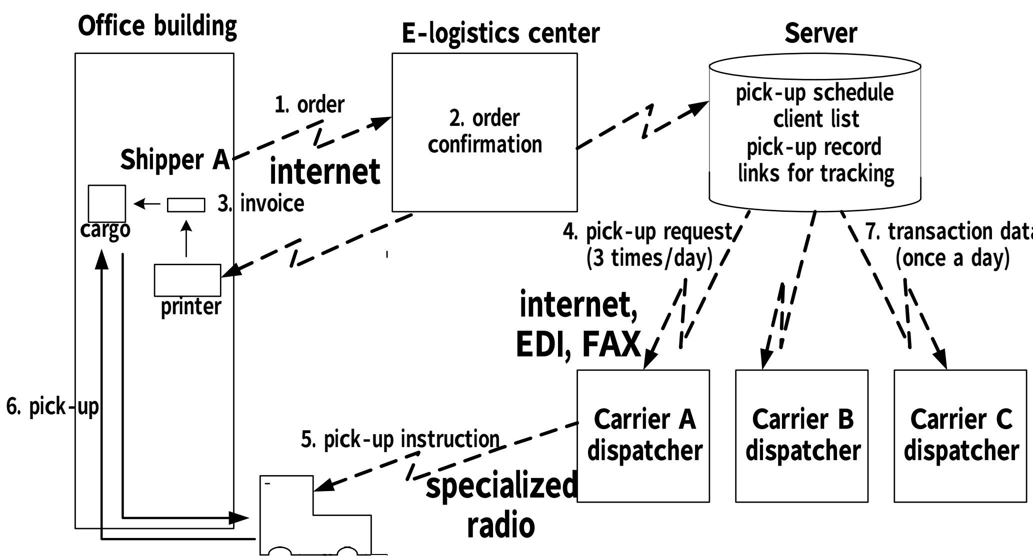


Figure 2 Implemented cooperative parcel pick-up system

## 4. Results of the Experiment and their Evaluation

### 4.1 Implementation of the experiment

The experiment was conducted on weekdays during the period from 28 January to 15 March 2002. The system was installed to 70 shippers (from 14 buildings) who signified their intention to participate in the experiment. This number consists of 0.2% of all the companies that perform business in the district. The participating carriers include top five in the parcel delivery business: Sagawa Express, Seino Transportation, Nippon Express, Fukuyama Transporting, and Yamato Transport.

However, the shippers that used the experimental system to request pick-up was very few. Only 12 shippers out of 70 used the system. In addition, the total number of parcels did not exceed 256 pieces, or 8 pieces per day on the average. Thus, the collection efforts of carriers three times a day did not result to an efficient pick-up system.

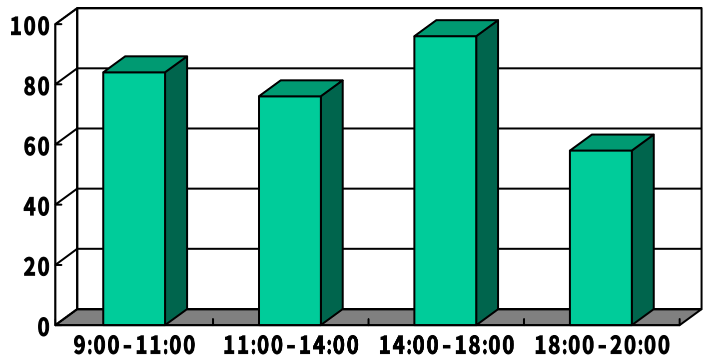


Figure 3  Number of collected parcels by time period

**4.2 Evaluation of the results**

Questionnaire surveys were administered to participating shippers and interviews were conducted to the carriers after the experiment.

The internet system was basically well operated by the shippers and indicated that they did not encounter any technical problems.  At the same time, however, there were a lot of negative replies to the question "Is the system more convenient or not?"  The reply "It got complicated" received a higher percentage than "It became convenient" (Table 2). It was believed that the use of the internet offers no benefits in cases when the amount of parcels per request is few.

Table 2  Evaluation from shippers: Convenience of the pick-up system

| | |
|---|---|
| It became convenient | 3 (15%) |
| No change | 4 (20%) |
| It got complicated | 6 (30%) |
| I do not know | 7 (35%) |
| Total | 20 (100%) |

It can be said that integrating the pick-up process to three times a day resulted to a reduction in the service quality. In the case of request for pick-up by telephone, a quick response can be expected usually. Even if the carrier cannot respond at once, the client is informed of the pick-up time by an operator orally, thereby having a sense of security. The use of the internet system is thought to have few economic benefits, and thus have no impact in increasing the amount of parcels being handled.

Although the following problems are actually experienced by the carriers: a) the list of pick-up addresses of shipments did not fit the present system for scheduling vehicles, and b) the standard invoice used was not enough to cover the various services offered by some of the carriers; there was no claim about the reliability and operability of the system itself. Technically, a mechanism can be developed to add the original services of each carrier in the standardized system.

In this experiment, the amount of handled parcels for pick-up was very few, and there were no significant curtailment effects such as the reduction of pick-up vehicles. However, there was indication from the carriers that benefits can be obtained if the range of geographical coverage and the number of shippers increases. Pick-up by telephone has been the current practice. However because of the inefficient collection of cargo, in which carriers sometimes go back and forth to the same building to collect cargo again after just a few minutes, there is certainly a need to improve the present pick-up system. Furthermore, they have also pointed out that this will be effective if one staff can stay in the building and be in-charge of the collection system at all times.

### 4.3 Tasks for the future

The internet matching system was proved to be technically feasible but economically unattractive. This experiment, however, was conducted given the existing institutional and regulatory arrangement, which we can relax when examining the economic nature of the system theoretically. We would like to keep an assumption that the internet matching system would bring economic benefits to the shippers, the carriers and the society under the different arrangement, and to demonstrate it in another experiment in future.

For this purpose, an economic model is developed (Figure 4), where social costs are introduced. In order for all stakeholders to obtain economic benefits to some extent, one of the necessary conditions that the cooperative parcel pick-up system must fulfil is reducing the total social costs. Here social costs include order costs of shippers, pick-up costs of carriers and traffic congestion costs. Also we assumed that pick-up costs are passed on to shippers by way of freight charges and that freight charges and order costs comprise the cost for shippers.

Despite the fact that the current collection activity causes traffic congestion, carriers have not been burdened with the traffic congestion cost, which others have come to bear, and shippers are not even held responsible for this problem. Certainly, the carriers alone should not be blamed. Among the causes of congestion is the lack of off-street parking spaces for the disposal of goods. Carriers have no alternative but to park on the street, whereas the police cannot strictly enforce any control measure. At any rate, there is no point or logic in comparing the cost of specific stakeholders with and without the cooperative pick-up system if we ignore the existence of external diseconomies.

On the contrary, if external diseconomies are to be internalized, it is possible to make a correct comparison of the impact of introducing the cooperative pick-up system. Here, a way of internalizing external diseconomies is, for example, to strictly restrain on-street parking and to permit trucks to park off-street with parking fees. Luckily, the government of Tokyo has compelled new buildings (more than 2,000 square meters) to provide off-street parking spaces for the disposal of goods since October 2002. This shows that the environment for controlling illegal parking has gradually been improved.

Traffic congestion cost will decrease and the cost of carriers will increase if vehicles are forced to use the off-street parking spaces with parking fees. Carriers will then be obligated to increase the amount of cargo to be picked-up per parking. It is under these conditions that cooperative pick-up system will have a significant impact.

Social costs can be reduced as external diseconomies are internalized. Although carriers have to pay new parking fees, which can be the cause of increased prices for services, it is eventually expected that parking fees can be saved and prices are reduced since the introduction of a cooperative pick-up system will result to efficient vehicle load usage. Even though there is no assurance that prices will decrease, it is possible to reduce the cost of shippers, composed of ordering cost and service price. The system will not become popular if these conditions are not anticipated.

Two additional conditions deserve examination. The first is the impact of the introduction of cooperative pick-up systems inside the building. These systems have been introduced in some of the buildings in Otemachi such as in Mitsui Trading and Shin-Otemachi Buildings to reinforce security by performing joint receiving and delivery inside the buildings. If this becomes successful and common, the shippers would be ready to accept the area-wide cooperative system as the extension of in-building system.

The second one relates to the coordination of cooperative pick-up with delivery. As clarified by our surveys, some of pick-ups are requested in the morning, when deliveries are usually carried out. A good collaboration between pick-up and delivery will result to even more efficiency. Although the problem is much more complicated, there is a need to investigate this coordination.

By combining these conditions, it can be shown that “reduction in social cost”, “reduction in carrier cost”, and “reduction in shipper cost” are highly probable impacts of the implementation of a cooperative parcel pick-up system by the internet.

Although it was discussed that it is necessary to reduce the cost of shippers to encourage and stimulate demand, it is also crucial that the carriers should have its benefits. The perceived benefits are less for the carriers. In our view, the carriers would be compensated with increased amount of freight cargo through the reduction of freight charges. This is because profits would increase in proportion to the amount of freight cargo supposing reasonable profit per cargo is accepted. Although the whole logistics industry may seem profitable, it does not imply that all the carriers are gaining profits. Carriers without competitive power in the process face the risk of elimination. It is important to obtain the understanding and cooperation of carriers as to this point in the future experiment.

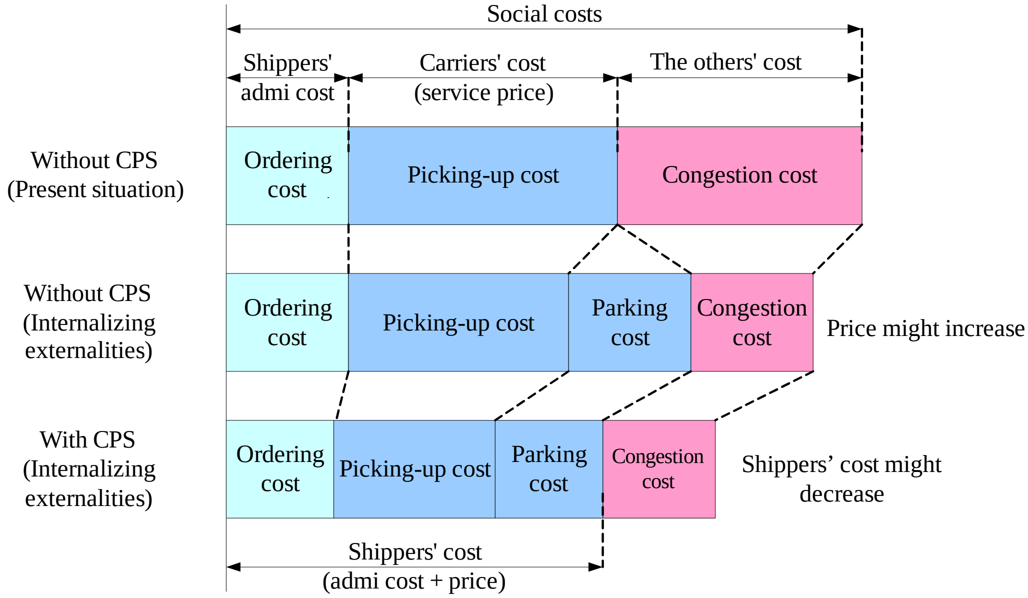


Figure 4 Social costs of pick-up with/without Cooperative Pick-up System (CPS)

## 5. Conclusion

The cooperative parcel pick-up system implemented in Otemachi did not caused any technical problems. However, only a small number of shippers used the system since the participating shippers were doubtful of its convenience, and there were no reduction in the freight charges. The carriers, on the other hand, indicated that the system could be of use if the amount of freight cargo for pick-up increases in future.

These results do not imply that the cooperative parcel pick-up system in the urban area should come to a negative conclusion. It was found out that the limited conditions during the experiment have resulted to the low utilization of the system, and thus, it is necessary to examine favourable conditions to increase the participation of companies and utilization of the system.

The economic model of social costs of cooperative parcel pick-up system suggests that reducing the total social costs would be achievable, and that all stakeholders including the shippers, the carriers and the society could obtain economic benefits to some extent with the introduction of cooperative parcel pick-up system if the external diseconomies are internalized by enforcing off-street parking, for example. Based on these considerations, we have to start to arrange another experiment.

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