Rationale for utilizing 3PL in supply chain management: A shippers' economic perspective

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1. Introduction

Recently the number of 3PL (third-party logistics) providers has increased rapidly in Japan as well as in other countries. 3PL providers are contracted to supply integrated logistics services and are closely related to SCM (supply chain management). In this paper we consider the rationale for utilizing 3PL in the supply chain. Efficient utilization of 3PL is expected to bring benefits such as reducing total costs. However, there seem to be certain conditions for utilizing 3PL efficiently. If so, what points should be considered? What are the necessary conditions for making efficient use of 3PL? It would be difficult in this paper to cover all of the various market and business forms of 3PL. Our purpose, therefore, is to identify discussion points related to the utilization of 3PL. We look, in particular, at features of 3PL utilization from an economic perspective, focusing on economic aspects of 3PL, the selection of 3PL providers, the problem of incomplete contracts, and asset ownership from the shipper's perspective. These points stem from arguments made in recent economic theories. The main contribution of this study is to identify discussion points from models and theories, such as contract theory, that relate to the utilization of 3PL in SCM.

2. Overview of 3PL

To confirm the concepts of SCM and 3PL, we first explain them by drawing on papers by Nemoto and Tezuka [1] and Nemoto, Tezuka and Futamura [2]. The supply chain consists of a set of processes associated with the flow of goods, information, and money among firms, from the raw materials supply stage through the production and consumption stage and finally to the recycling stage. SCM is a tool for optimizing the supply chain through integrated management. Since SCM involves inter-firm activities, it encompasses functions such as raw materials supply, production management, transportation, inventory management, information system management, order processing, material handling, and customer management.

Furthermore, international SCM also includes procedures related to customs clearance. One of the main features of SCM is that vertical process integration from suppliers through customers can be performed through strategic inter-firm alliances. A well-designed SCM yields positive net value by creating benefits, reducing costs, and improving financial viability (such as profitability). That such outcomes can be obtained without mergers (integrating all processes within one firm) may reduce the transaction cost of integration.
The general idea of logistics is to strategically manage the total flow of goods. Logistics optimization, therefore, cannot be achieved only from the viewpoint of one firm; it requires total optimization of the flow of goods across all firms in the supply chain.

Firms that possess logistics know-how in coordinating economic resources may have opportunities to provide advice. Such logistics coordinators, also called third-party logistics (3PL) providers, have been gaining attention. 3PL is a type of industry in which the shipper's logistics activities can be outsourced. It is common 3PL practice not to outsource discrete logistics activities individually but rather to outsource multiple activities from the firm's strategic point of view. 3PL providers today have the following characteristics:

1. Integrated (or multi-modal) logistics service providers
2. Contract-based service providers
3. Consulting service providers

The advantages of using 3PL result from economies of scale (merits from large truck fleets, warehouses, etc.) and economies of scope that encourage firms to increase net value by reducing costs. The effects of these economies vary depending on whether the 3PL provider is an “asset-type” or “non-asset type” provider. The former owns logistics-related assets such as truck fleets or warehouses while the latter does not. In the Japanese context, therefore, non-asset type 3PL providers correspond to forwarders, generalized trading firms, or consultant firms.

Competent 3PL providers are skilled at coordination, enabling them to search out reliable partners or sub-contractors and efficiently manage the inter-firm flow of goods. Such abilities can be developed through experience as a 3PL. Later we will consider the sources of such experience and specialization.

At the same time, outsourcing logistics activities firms are able to save on capital investment and reduce financial risk. Investment in logistics assets such as physical distribution centers or information networks usually requires large lump sum costs that involve financial risk. 3PL providers can spread their risk by outsourcing to sub-contractors.

Regarding the role of supply chain coordinators, the concepts of 4PL (fourth-party logistics) and LLP (lean logistics provider) have also recently been introduced. According to Vitasek [3], they differ from 3PL as follows:

1. A 4PL organization is often a separate entity established as a joint venture or long-term contract between a primary client and one or more partners.
2. A 4PL organization acts as a single interface between the client and multiple logistics service providers.
3. All aspects, ideally, of the client's supply chain are managed by the 4PL organization.
4. It is possible for a major 3PL logistics provider to form a 4PL organization within its existing structure.

In other examples, Craig [4] defines 4PL as a business process outsourcing provider while Mukhopadhyay and Setaptra [5] regard 4PL as a supply chain integrator. It is, however, sometimes difficult to differentiate between 3PL and 4PL as their definitions sometimes overlap in terms of their functions. Further, in the Japanese context, the concept of 4PL seems to be regarded as a kind of non-asset type 3PL provider. In the following, therefore, we utilize the term 3PL/4PL where it seems necessary.

3. The functions of 3PL in supply chains

3PL has attracted considerable research attention. Marasco [7] conducted a comprehensive review of 3PL using a content analysis framework (Fig. 1). Among the many issues about 3PL raised in Fig. 1, we focus on the following: constructing SCM and the conditions under which 3PL providers are well-utilized by shippers. To examine this problem, for the present, we make two assumptions. First, a shipper constructs a supply chain. Second, the shipper outsources integrated logistics activities in their supply chains to 3PL providers.

Under these circumstances, we focus on 3PL provider specialization. 3PL providers provide shippers with specific logistics activities in an integrated chain. Such effects of specialization might have a number of sources.

First, specialized 3PL providers have the advantage of their own experience. (The accumulation of experience can be described as the accumulation of know-how.) Experienced 3PL providers engage in logistics activities more cost-efficiently.

A representative example of know-how is IT-related activity. IT-related activities such as database management or data processing in inventory or warehousing play a major role in the provision of logistics services. IT-related activity requires specialized skills and offers easy differentiation from other providers.

Another example is the recent utilization by many Japanese firms of 3PL providers when entering new foreign markets such as ASEAN. Many Japanese firms require logistics management experience in these markets because they lack know-how; 3PL providers are frequency utilized in such international contexts.

The know-how of experienced 3PL providers might make for more efficient logistics activity that enhances supply chain performance. Logistics performance may influence overall supply chain performance. Therefore, shippers may outsource logistics activity to 3PL providers when entering foreign market and making supply chains.

These advantages of experienced 3PL providers come from a learning effect: the more services they provide, the less they cost. Shippers that utilize 3PL providers enjoy such effects. If the experience of 3PL providers can be imitated by others, however, shippers will see little effect over the long run from utilizing 3PL providers. When constructing international supply chains, however, such imitation seems to pose many difficulties.

A second effect of specialization is related not to producing activities but to searching and information advantages. We next focus on 3PL searching ability. 3PL providers may not provide all logistics services by themselves but rather outsource to subcontractors. That is, competent 3PL providers are highly skilled at coordination, enabling them to search out reliable partners and subcontractors to efficiently manage the inter-firm flow of goods.

With regard to informational advantages, 3PL providers must not only search out sub-contractors but sometimes also partners and customers. For example, as Nemoto, Tezuka and Futamura [2] have observed, Japanese generalized trade firms or forwarders acting as non-asset type 3PL providers have constructed efficient supply chain logistics schemes when entering the Chinese logistics market. They did so by selecting better Chinese domestic carriers. In this case, the high searching ability of 3PL providers enabled better selection of China domestic providers to achieve a more profitable (more cost efficient) outcome. Such profits could be shared so shippers also gained. High searching ability depends on 3PL provider information advantages. In undertaking such activity, 3PL providers can be seen as intermediaries between shippers and individual subcontractors.

We assumed that shippers would construct supply chains so we could evaluate 3PL providers by their searching (or intermediaries) and abilities. If shippers can select an appropriate 3PL provider, they

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2. Marasco [7] used a framework to clarify much of the literature related to 3PL. Such literature is easily accessible.
5. The relationship between experience and searching ability might not be independent.
can improve the total efficiency of the integrated supply chain. In other words, high ability 3PL providers contribute to the construction of generally more efficient supply chain processes. Nemoto and Tezuka [1] describe the conceptual relationships between 3PL and SCM (Fig. 2).

### 4. Principal–agent relationships

3PL providers are basically integrated, contract-based logistics providers. The relationship between shippers and 3PL providers can be viewed as a principal–agent relationship. We usually describe those who delegate tasks as “principals” and those to whom they are delegated as “agents.” In this case, shippers are “principals” and 3PL providers are “agents.”

In the principal–agent theory of economics, desirable types of contract would depend on conditions such as ease of monitoring and performance evaluation, the attitudes toward risk of each participant, and so on. In addition, as seen in Fig. 2, 3PL providers have many trading relationships in their horizontal/vertical processes. Compared to integrated providers, they have intricate webs of relationship that raise transaction costs. Why are 3PL providers utilized despite such complexity?

The first reason is to spread risk by outsourcing logistics tasks. For example, as Nemoto, Tezuka, and Futamura [2] suggest, shippers can avoid taking on some risks by delegating some operations and investments to 3PL providers, especially when they are trying to enter new and as-yet-unknown markets. It seems that asset-type 3PL providers assume more risk than non-asset type 3PL or 4PL providers.

The second reason, as mentioned above, is that 3PL providers are expected to bring benefits by exercising their specialized abilities in areas such as searching or coordination. If the benefits of 3PL providers can be shared with shippers, it is advantageous for shippers to outsource their logistics activity. The shippers’ gain from using 3PL providers will depend on such abilities. From the shipper’s perspective, it is important to select a 3PL provider with the right specialized abilities.

Regarding the latter point, the benefit of utilizing specialized 3PL providers can be related to the concept of agency efficiency. If agency efficiency can be appropriately exercised by 3PL providers, the total economic cost of supply chain processes can be minimized, or net value maximized. Here, total economic cost also includes transaction costs, the cost of coordination among supply chain firms, etc. Conversely, obtaining greater gains through the utilization of 3PL/4PL providers requires a relationship of high agency efficiency between them. We also see these points applied to cases of Japanese firms entering the Chinese market in Nemoto, Tezuka, and Futamura [2].

### 5. The importance of 3PL provider selection

3PL provider selection is important for shippers to enhance agency efficiency. Roughly speaking, there are two types of selection: open competition and closed selection. Open competitive selection has some advantages over closed selection.

The advantages of using open competitive selection are obtained because many agents participate in open selection, competing among themselves. This is different from normal competition in which each agent provides services in a certain market. Rather, each provider offers service content to the shipper (client) in franchise bidding. That is sometimes called “competition for the market” whereas normal market competition is called “competition in the market.”

There are two advantages when “competition for the market” occurs. First, each bid participant has incentives to offer cost reductions...
or beneficial services. Second, the process of competition offers the possibility that a superior 3PL provider with innovative activity may emerge.

However, the closed model is frequently employed, particularly in the Japanese context, because open competition invites the following problems. First, using open competition means that shippers must assume the risk that stems from outsourcing to an as-yet-unknown 3PL provider. When an unknown 3PL provider is selected, the character of the provider may not be clear to shippers. In other words, the problem of asymmetric information between shippers and 3PL providers might arise. Outsourcing overall logistics activities to a 3PL provider may have a great impact on the earnings of the shipper. Losses due to failure by a 3PL provider selection could be great.

With respect to the risk caused by asymmetric information between 3PL providers and shippers, Nemoto, Visser and Yoshimoto [10] noted that when shippers choose freight transport companies through open auctions using the Internet, there may be a high risk of low-quality service. True, transportation costs may be reduced through the use of Internet open auctions. But it is sometimes observed that the risk of lower quality overwhelms the cost savings from the using open selection. Selection through the Internet can be said to have the highest level of openness to the public. Shippers, therefore, may face a comparatively high risk of an as-yet-unknown partner and asymmetric information. It is necessary to get to know the other party well in a competition open to the public to decrease this risk, and careful selection is required.

Second, the problem of the “winner’s curse” is also raised in severe competitive auctions or in uncertain circumstances.7 The winner’s curse is a situation in which the highest and the most optimistic bidder wins the bid, but ultimately takes a loss. It is sometimes suggested that one factor in failures of 3PL sourcing is “over promising and under-delivering,” which can be interpreted as a kind of winner’s curse. Kodaira [12], a 3PL practitioner, stated that “I frequently observed that Japanese 3PL providers (freighters) undertook operations with negative earnings. However it was difficult for the provider to continue to operate under those conditions and finally their contracts were canceled.” In sum, such cases of the winner’s curse can easily be found in open competition selections, especially in Japan.

Third, many participants are expected to tender in the open selection of 3PL providers. Transaction costs, therefore, rise as the number of bidders increases. Selecting a 3PL provider requires a multi-index evaluation including estimated cost, service quality and so on, making the work of selection more difficult than the standard single-index auction that compares cost. Some papers reinforce this point. For example, Vaidyanathan [13] provided criteria for evaluating 3PL providers. He employed six factors such as IT, quality, cost, service, performance metrics, and intangibles, and found that the role of IT is important when shippers utilize 3PL providers.

In addition, an open auction might sometimes disclose information important to the shipper’s firm. Such disclosure might generate risks for shippers. Indeed, non-disclosure contracts are often required at the selection stage.

As stated above, in selecting 3PL providers shippers are also required to evaluate 3PL providers’ abilities. If a shipper does not have the ability to evaluate 3PL providers, it may need to retain consultants to make the selection. This means additional transaction costs are required.

As a result, while the benefits of agency efficiency increase through the open competitive selection of 3PL providers, transaction costs also increase. Therefore, choosing the method of 3PL provider selection (open or closed) requires considering such trade-offs and any other influential factors.

6. Incomplete contracts and “hold-up” problems associated with the use of 3PL providers

Other problems associated with using 3PL providers include the manner of contracting between shippers and 3PL providers. Williamson [14] reviewed the role of outsourcing in SCM from a transaction cost economics perspective. Contract theory has been developed recently in connection with transaction economics. As mentioned above, 3PL is also called “contract logistics,” and contract performance is important for both parties. Although 3PL providers may be capable of conducting their business, they may be unable to provide service at desirable levels due to the problem of contract incompleteness. Removing such difficulties requires specifying ex-ante agreements in detail, which implies that contracts should be written as completely as possible to avoid “hold-up” problems stemming from incomplete contracts. We will explain the problem in detail below.

3PL providers undertake logistical multi-tasking and sometimes further outsource to subcontractors in the supply chain. They have a “nexus of contracts” in the supply chain. The relationship among stakeholders when utilizing 3PL providers becomes more complex than when shippers conduct logistics activities by themselves (in-house operation) or when shippers simply outsource each task such as transportation or warehouse operation individually. In short, transaction costs are higher when using 3PL than for either in-house or individual outsourcing. When shippers outsource business, the benefits should exceed the costs. To offer the benefit of using them, as mentioned above, 3PL providers must demonstrate specialized abilities. Doing so requires appropriate risk (and gain) sharing between shippers and 3PL providers.

Specialization that takes advantage of 3PL utilization stems from assets. Such assets include not only tangible one like fleets, warehouses, and logistics facilities but also intangible one like the accumulated knowledge of each firm. The benefit by using 3PL will depend on how well these assets are managed. Obtaining the benefit of such assets requires appropriate incentives. If a 3PL provider and a shipper can sign a contract with desirable incentive mechanisms, both parties gain in a so-called “win–win” relationship. However, it is not easy to design contracts with such compatible incentives. The more complicated tasks and relationships that emerge when utilizing 3PL make signing an appropriate contact particularly difficult.

The contract theory in economics states the problem of incomplete contracts. If the contract between a shipper and a 3PL provider is incomplete, it creates additional costs. In the case of contract incompleteness, each party can observe but cannot verify. This unverifiability means each party has an incentive to behave opportunistically with regard to irreversible investment. That is, if a party such as a 3PL provider conducts firm-specific investment (investment that is irreversible and cannot be diverted to other usages), it faces the risk of opportunistic behavior.

If the 3PL provider has invested in (constructed) logistics facilities for a specific shipper that cannot be easily diverted to the use of other shippers, the shipper might have an incentive to negotiate, for example, a price reduction with the 3PL provider after construction of the facilities. Such a renegotiation is “opportunistic” behavior by the shipper. It costs the 3PL provider to cancel investment because the assets are irreversible and firm specific. Conversely, the 3PL provider has fewer incentives to invest in such firm-specific assets. This is the so-called “hold-up problem.”

The main reason that the hold-up problem occurs is incomplete contracts. If the contract between the shipper and 3PL provider is complete, the behavior of both parties can be verified by outside third parties to avoid opportunistic behavior. Difficulty in writing a complete contract creates an increased risk of hold-up problems.

In general, under circumstances where hold-up problems could arise, each party has less incentive to invest in specific assets, even when such investment could generate more profit. In other words,
although avoiding the hold-up problem and promoting firm-specific investment can be desirable for both parties, under-investment may still occur. For example, under an incomplete contract, a 3PL provider might construct logistics facilities such as warehouses not to meet the specific needs of client-shippers but rather to have broad utility in the event of contract cancelation. This situation impedes the achievement of win-win outcomes through the use of 3PL. If so, what conditions are required so that each party can avoid hold-up and under-investment problems?

7. Who should own assets?

In considering the ownership problem, we apply the model from Hart [15] to a 3PL contract. There are two players: shipper and 3PL provider. Each player has firm-specific assets: AS for those of the shipper and AL for those of the 3PL provider. The firm-specific assets create additional value if each asset is owned by each player. That is, a shipper using asset AS with input i generates added value (such as profit) of $R(i)$. In contrast, cost savings of $C(e)$ are obtained if the 3PL provider utilizes asset AL with input e units. It is assumed that levels of input i and e can be observed but not verified. These inputs are assumed to involve additional costs. Then, as mentioned above, under an incomplete contract, levels of input by each player are smaller than the optimal/most efficient levels because of the hold-up problem (Fig. 3).

Hart [15] addressed the issue of who should own assets in various situations. If each input is independent of the overall benefit—that is, if there is no additional gain from one player utilizing the other’s asset (e.g. the shipper uses AL or the 3PL provider uses AS)—then each player should have their own asset. Conversely, if each input is interdependent and assets are complementary – meaning both are required to get additional gain – one player should have the two assets and AL together. In the latter case, integrated in-house operation by the shipper is preferred.

If the two assets are strictly complementary, and if one party’s input is inelastic and the other’s is elastic, then the latter party whose operation by the shipper is preferred.

The problem of the trade-off between asset specificity and 3PL performance has been considered by Aertsen [16], and it seems we can determine the more desirable types of ownership by using the above framework and soon see the applicability of contract theory to 3PL. Although these suggestions above are only a fraction of the application of the theory, that has much room for application to 3PL in the supply chain.

8. Environmental concerns and the utilization of 3PL

Generally speaking, there has been rapid growth in the attention directed toward environmental burden, and it is now important to consider environmental issues. Therefore, we briefly consider the relationship between environmental issues and 3PL in SCM.

From an economic viewpoint, some environmental issues can be attributed to the “externality” problem. The main issues pertaining to the environment, sustainability and externality in a logistics context are considered to be freight transport CO2 or local pollution. Utilizing 3PL providers may sometimes reduce environmental cost through more efficient operations (of vehicles, for example). However, the main purpose of companies such as shippers and 3PL providers is to reduce costs or secure profits, which may not coincide with environmental concerns. Therefore governmental policies or market interventions may be required to attain environmental friendly outcomes.

However, efforts to conduct business in an environmental manner have also been growing rapidly. Environmentally friendly logistics concepts such as green logistics and reverse logistics have been catching on. A case may therefore be made that private companies have an incentive to respond voluntarily to environmental issues. “ISO14001” certification is one example. Each firm has an incentive to acquire it to enhance the reputation and market value of the firm. Indeed, the number of shipping companies that address environmental issues in their CSR (Corporate Social Responsibility) activities is increasing.

Regarding certification such as ISO14001, the Foundation for Promoting Personal Mobility and Ecological Transportation in Japan began a certification program for Green Management (business operations with low environmental load) in the trucking business on October 2003. Some 3PL providers have such certifications and promote themselves to shippers as environmentally friendly companies. For shippers that are interested in environmental issues, certification seems to be an important factor in the selection of a 3PL provider.

While environmental concerns have been growing rapidly, with regard to the relationship between 3PL and reverse logistics, Wolf and Seuring [17] pointed out that 3PL utilization decisions are still made on traditional performance criteria despite the increasing interest in environmental issues by shippers. They insist, therefore, that, when it comes to selecting a 3PL provider, shippers should take environmental criteria into account and manage environmental impact jointly with the selected 3PL provider. Mukhopadhyay and Setaputra [5] stated that utilization by 3PL/4PL providers of reverse logistics processes has been growing. However the concept has not taken root yet. They also use economic models and numerical examples to show the role of 4PL as a logistics integrator. Similar to other countries, Japanese companies tend to be more conscious of environmental issues these days, which makes shippers’ companies utilize 3PL within sustainable environmental constraints.

9. Concluding remarks

In this paper we first proposed a conceptual framework for evaluating 3PL utilization in SCM, where we assumed that shippers could enjoy advantages derived from four contributory sources of 3PL specialization: scale, know-how, searching ability and/or IT skills. It
was also supposed that shippers could benefit from 3PL particularly when facing uncertain business environments.

We also applied principal-agent relationships to shippers and 3PL providers. Further, we saw that enhancing agency efficiency is important to obtaining benefits from utilizing 3PL. We also looked at issues such as the role of 3PL provider selection, the hold-up problem under incomplete contracts, and asset ownership. These are the main points that we considered regarding 3PL utilization.

The main contribution of this study is to try to apply arguments from recent economic theories, such as contract theory, to the context of 3PL utilization in SCM. However, we apply only a small part of models and theories, such as contracts theory, and much remains to be addressed by future research. The paper employs a conceptually based approach and we discuss some points using existing economic models. Therefore, it will be necessary to examine the usefulness of these points through quantitative or qualitative analysis. In addition, we need to consider the relationship between environmental concerns and the utilization of 3PL in more detail. In fact, there are many cases of 3PL utilization in Japan and internationally to be addressed in future research.

References


