

## **Transportation Collaboration: Partner Selection Criteria and Inter-Organizational System (IOS) Design Issues for Supporting Trust**

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### **ABSTRACT**

The empty truck problem is a costly logistics issue that many companies have faced. Collaboration among competitors providing logistical solutions is very difficult and might not take place at all without support and intervention by the government. This study addresses the horizontal transportation collaboration among competitors that has been initiated by a government agency in Thailand. A survey was carried out of two groups comprising 31 “would be” collaborators – shippers and carriers – using a convenient sampling scheme. The study was designed to explore partner selection criteria during the formation stage and to explore the related design factors of an inter-organizational system (IOS) that supports trust among these collaborators. The result includes a comparison of the pre- and post-exposures to the IOS paper-based prototype that has incorporated some theoretically desirable features of collaboration. The results show positive relationships between direct prior alliance experience and some elements of trust and also between commitment and trusting intention in potential partners.

**Keywords:** Transportation collaboration, partner selection criteria, inter-organizational system design

## 1. INTRODUCTION

Because logistics activities are so costly, organizations devote considerable effort to ensure their efficient performance. Transportation is one of the most important components, accounting for about 41% of total logistics cost in Thailand. Although the average cost per kilogram of land transportation is higher than that for rail and water transportation, land transportation (about 85.47%) is the dominant mode of Thai domestic transportation.

When the price of oil increases, transportation costs also increase, leading to political and economic crises for developing countries like Thailand. Every possible measure has been considered to reduce the cost of operations. Many organizations try to improve their transportation activities to reduce cost. Many believe that there are no additional measures to be taken.

According to a study by the Department of Land Transport in 1996–2000, about 46% of total truck trips in Thailand were empty. If organizations can solve this empty truck problem, their transportation costs would certainly be reduced. The problem is difficult to solve by individual organizations alone, however, because most organizations usually transport their shipment one way at a time in either line-haul or back-haul. Only a few organizations are successful in balancing their line-haul and back-haul shipments.

The empty truck problem could possibly be solved if organizations were to engage in transportation exchange with one another. This kind of inter-organizational collaboration, however, is not easy. Many such collaborations fail, especially those among competitors. Quite a few studies address the inter-organizational collaboration issue; however, very few focus on transportation collaboration using an inter-organizational system (IOS) [13]. There is a need also for criteria to select appropriate partner organizations.

Drawing from the literature on success factors during the formation stage of collaboration, the present study aims at exploring and developing partner selection criteria for transportation collaboration. It also focuses on an IOS that supports activities such as information exchange and communication.

A number of factors affecting the design of a successful IOS are found in the literature. These include integration, security, standards, and hardware and software infrastructure [21, 28, 34, 49]. This study, however, focuses on the factor called “trust.” A trust-related conceptual model is proposed and empirically validated. Specifically, the objectives of this study are:

(1) to identify partner selection criteria using relevant success factors during the formation stage of transportation collaboration;

(2) to examine the design factors of IOS that will facilitate trust among partners;

(3) to develop a conceptual model for partner selection criteria and empirically test the relationships between constructs in the model; and

(4) to compare the extent of trust among partners during pre- and post-exposures with a simple IOS prototype developed in this exploratory study.

The paper is organized as follows. Section 2 reviews related literature. Section 3 discusses the proposed conceptual framework of partner selection criteria. Section 4 presents and discusses the methodology of the survey and presents data analysis and results. Section 5 focuses on research implications and limitations and presents study conclusions.

## **2. LITERATURE REVIEW**

This section reviews related literature on inter-organization transportation collaboration (2.1), the transportation collaboration life cycle (2.2), partner selection criteria for transportation collaboration (2.3), and the trust-supporting design of an inter-organizational system (2.4).

### **2.1. Inter-Organizational Transportation Collaboration**

Organizations typically collaborate with one another in order to pursue a shared goal. This collaboration can be formal or informal. In the literature, different words and vocabularies are used to represent this concept, including “inter-organizational collaboration,” “inter-organizational cooperation,” “strategic alliance,” and “partnership.” “Inter-organizational collaboration” is often used for an inter-organizational level, but it is unclear whether the collaboration is formal, long-term, or strategic [2, 7, 12, 25, 26, 27, 35, 38, 43, 48, 51, 53]. In this paper, the author uses the term “transportation collaboration,” which is short for inter-organizational transportation collaboration, to refer to the collaboration among organizations engaging in transportation activities.

There are many ways that organizations can collaborate. Inter-organizational collaboration can be classified into a number of categories, such as functional, intra- or inter-industry, intra-international, strategic and operational, equity arrangement, and supply chain [29, 52, 58]). The supply chain category is further divided into vertical, horizontal, and lateral collaboration [52]. Vertical collaboration is the partnership along the supply chain; and horizontal collaboration is among companies within the same level of the supply chain. Vertical and horizontal collaboration can be integrated into lateral collaboration.

This study focuses on horizontal inter-organizational transportation collaboration. The horizontal concept is relatively new and differs from vertical collaboration in that organizations need to collaborate with their competitors. This type of collaboration can be formed, for example, among carriers or among shippers. Since collaboration among competitors is difficult, it is unlikely to happen without support from the government. The transportation collaboration effort described in the present study, for instance, has received initial support from a government agency.

The main goal of this collaboration is to reduce the empty truck problem, thus eventually reducing transportation cost. This objective could be accomplished by transportation exchange among shippers in the following manner. If a shipper’s shipment is only in one haul (line-haul or back-haul), this shipper would make either of the following choices: (1)

request a shipment for its empty route from other shippers (in-sourcing), or (2) give the shipment to another shipper who can carry it (out-sourcing). Transportation exchange can thus be viewed as a combination of both out-sourcing and in-sourcing transportation.

The present study also focuses on the formation stage of transportation collaboration. This stage is compared to transition to a federation or initializing stage in the literature [15, 59]. In this stage, no transportation exchange has occurred yet. This is the stage when the decision is made about which organizations will join the collaboration. In this stage, a particular organization knows only which organizations are potential partners, but it does not know which organizations will be its actual partners. Nevertheless, procedures and rules such as information exchange standard, benefit-sharing scheme, and insurance method are discussed and defined extensively by organizations in the collaboration scheme.

## **2.2. Partner Selection Criteria for Transportation Collaboration**

One of the objectives of this study is to develop partner selection criteria for transportation collaboration. The author develops these criteria from a success factor during the formation stage. Since there are many definitions of inter-organizational collaboration success, the first task is to define transportation collaboration success. Unfortunately, there is no consensus on this definition.

In the context of strategic alliance, performance was widely used to measure success [2, 18]. In line with the work of Venkatraman and Ramanujam on business performance [54], Arino proposed that strategic alliance performance can be measured at three levels: financial performance, operational performance, and organizational effectiveness [2]. Financial performance is relevant only when strategic alliance has a financial goal. Operational performance “focuses on those key performance success factors that might lead to financial performance” [54]. In transportation collaboration, operational performance measurements could be longevity and survival [2]. Organizational effectiveness depends on the specific organizational goal. In the logistics context, Chow, Heaver, and Henriksson [10] argue that logistics performance is multi-dimensional, reflecting multiple stakeholders. In transportation collaboration, the measurements could be reducing transportation cost, reducing overall empty truck trips, and transportation performance satisfaction.

Inter-organizational collaboration success factors can be identified from two perspectives: economic and social. From the economic perspective, transaction cost theory essentially explains the existence of different firms and analyzes the optimality of specific coordination mechanisms, depending on transaction characteristics [56]. According to Williamson, transactions can be characterized by three critical dimensions: frequency, uncertainty, and asset specificity [57]. The more level these dimensions are, the more organizations tend to use cooperation and hierarchy rather than the market as the coordination mechanism. In transportation collaboration, organizations with transportation

complementarity – that is, organizations that transport their shipments in complementary or opposite routes – will have a higher frequency of transaction than do others. Thus, the transition from market to collaboration will produce lower transportation costs. Cost reduction is an important motivation for organizations to engage in transportation collaboration. Higher cost reduction can increase transportation exchange. Thus, perceived cost reduction, in the formation stage, is also included in this study. The study does not focus on factors such as cooperation [1], involvement [41], opportunism [57], and openness [6] because they are not relevant in the formation stage.

The social perspective is quite different from the economic perspective. Social exchange interactions result not only in economic outcome, but also in social outcome [36]. Transaction cost theory has a limited explanation of a certain transaction, but does not describe a long-term relation. In transaction cost theory, only an appropriate governance structure can eliminate opportunistic behavior [56]. From the social perspective, an exchange interaction over time produces relational exchange norms that govern the exchange relationship [36]. Factors such as trust and commitment can reduce monitoring cost and make collaboration possible and flexible. In transportation collaboration, a governance structure such as contracts only is too rigid and not adaptive enough for today's rapidly changing businesses. Furthermore, two important factors, trust and commitment, are central to success in business relationships [44]. Although trust and commitment can be developed during transport collaboration, this study includes the two factors because they are relevant in the formation stage. This is because organizations can obtain information such as competencies of other organizations from prior direct alliance, prior indirect alliance, and reputation [24]. This study also includes prior direct alliance experience because this factor is an important source of information about trust in other organizations and commitment in transportation collaboration.

To summarize, the partner selection criteria of transportation collaboration identified for this study are: (1) transportation complementarity, (2) perceived cost reduction, (3) commitment, (4) trust, and (5) prior direct alliance experience.

### **2.3. Designing IOS to Support Trust**

One of the objectives of this study is to explore the design factors of the IOS that support and facilitate trust between partners. The author first introduces the general features of IOS and then discusses in detail trust and the role of trust in IOS design. In the broadest sense, IOS is an information system that supports inter-organizational activities [8, 9, 16, 28, 33]). In transportation collaboration, organizations use IOS to exchange information (e.g., truck and, shipment information).

Although this paper uses only the term “IOS,” many different terms and definitions are closely related to IOS in the literature (Table 1). IOS has been widely studied, especially in the electronic data interchange (EDI) area [11, 28, 55]. EDI has often been used between buyers and suppliers and along the supply

chain in a vertical manner. However, IOS is defined differently from EDI in this study. In transportation collaboration, organizations collaborate with their competitors in the supply chain; that is, in a horizontal manner. Exchanging information with competitors is not a normal business practice, for a number of reasons. One very important reason has to do with trust. If an organization does not feel confident its partners will treat the information it has delivered in good faith, it will not provide the information. Thus, trust is a necessary condition for both information exchange and transportation collaboration success. This study, therefore, focuses on how to design an IOS to support trust among organizations.

**Table 1**  
**Related IOS Terms and Definitions**

<b>Related IOS Term</b>	<b>Definition</b>
Inter-Organizational System	Automated information systems shared by two or more companies [8]
	IOS exists to support and implement cooperation and strategic alliances between two or more organizations. [33]
	IOS consists of computer and communications infrastructure for managing interdependencies between firms. [9]
Inter-Organizational Information Systems	IOIS's are computer networks that support information exchange across organizational boundaries. [16]
Inter-Organizational Computer Networks	Inter-organizational computer networks support the exchange of computer-stored information across organizational boundaries. [28]
Inter-Organizational Information-Sharing Systems	Inter-organizational information sharing system is a general term referring to systems that involve resources shared between two or more organizations. [5]
Extra-Corporate System	Extra-corporate systems operate beyond organization boundaries for linking buyers and sellers or companies performing similar functions. [31]

Although trust is a feature of everyday life, there are different ways to define the term. A common understanding is that trust is the expectation that vulnerable action will be fulfilled [23, 37]. Trust is important in high-risk and outcome-aversion situations [40, 45]. In transportation collaboration, an organization faces the risk of losing its shipment or having low transportation quality if it lets others do the transport instead of performing the task itself.

Conceptualization of the various levels of trust can be complex. One may have a different level of trust for people in different situations [14]. For example,

Somchai trusts Somsri with regard to her cooking ability; so, he does not hesitate to eat food that she has cooked, but he may not trust her driving skill. Trust is not static; it changes over time because of previous interactions [60]. It can occur at both the inter-individual and inter-organizational level [14]. Trust can also be classified as either cognition-based or affect-based [32]. Cognition-based trust is a rational view of trust associated with competence, ability, and reliability; whereas, affect-based trust has more to do with emotional elements such as benevolence and altruism. This study adopts the trust-integrated model proposed by McKnight, Vivek, and Charles [42] and thus focuses on trusting beliefs and trusting intentions. Trusting beliefs comprise competence, benevolence, and integrity; trusting intentions use only the subjective probability of dependency.

In information systems literature, especially in the area of e-commerce, many researchers are interested in how to design and implement an information system to enhance trustworthiness. Their studies appear to be dedicated to establishing guidelines to increase the perceived trustworthiness of technology or of the actors the system represents [46, 20]. Researchers have found that features such as high-quality photographs, comprehensive information about the product, and contact information can increase trustworthiness. This approach, however, raises some concerns that, if bad guys follow these guidelines, users of the information system will be in a risky situation. This problem is called “mimicry,” and will occur when untrustworthy actors deliberately appear trustworthy in order to obtain the benefits [3].

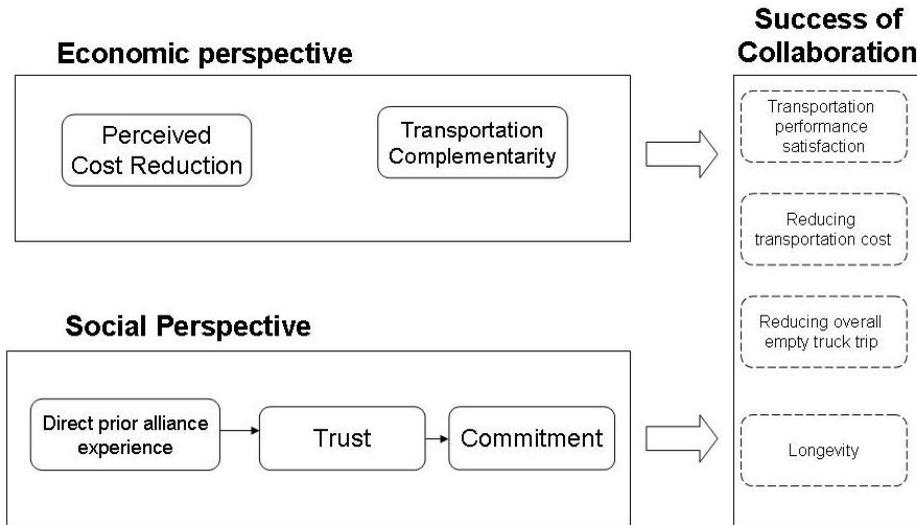
Riegelsberger, Sasse, and McCarthy [50] proposed the “mechanics of trust” to tackle this problem. Their framework identifies trust-warranting properties so that persons can be rationally confident that their vulnerable actions will be fulfilled. Trust-warranting properties comprise both contextual properties (e.g., existence of law enforcement agencies and fear of punishment) and intrinsic properties (e.g., internalized norm). According to the framework, a person will fulfill only if he or she has the ability and if the motivation provided by the contextual and intrinsic properties outweighs the motivation to realize the gain from non-fulfillment [3].

In line with trust-warranting properties, Riegelsberger, Sasse, and McCarthy [50] presented design heuristics for an information system comprising (1) stable identity, (2) traceability and accountability, (3) group membership and group identity, (4) social presence, and (5) recording outcomes. These design heuristics can be applied to the case of IOS in transportation collaboration. For example, IOS should provide information about which organizations help each other in transporting their shipments (stable identity) and providing information about the quality of transportation (recording outcomes).

### **3. CONCEPTUAL FRAMEWORK**

The conceptual framework for this study, shown in Figure 1, separates partner selection criteria into two perspectives: economic and social. The

economic perspective has two constructs leading to success in the collaboration: perceived cost reduction, and transportation complementarity. The social perspective constructs are trust, commitment, and direct prior alliance experience.



**Figure 1. Conceptual Framework for Current Study**

### 3.1. Transportation Complementarity

An organization will have transportation complementarity with others if its trucks can carry the shipment of others and have available capacity (empty truck trip) for the shipment of organizations in the opposite direction. Thus, transportation complementarity is defined here as complementarity in transportation among organizations in collaboration regarding truck-shipment compatibility and geographical complementarities between available capacity truck and shipment.

### 3.2. Perceived Cost Reduction

With transportation collaboration, some transportation cost elements might decrease whereas others might increase. Transportation cost can be reduced by sharing transportation resources such as trucks (thus, reducing empty truck trips). However, some costs of collaboration are unavoidably incurred, such as technology investment and training expenditure. Perceived cost reduction is defined here as the perceived cost of net transportation cost reduction, minus the cost increase from transportation collaboration.

### 3.3. Commitment

Commitment has been defined as “an implicit or explicit pledge of relational continuity between exchange partners” [19]. If there are no external forces impelling organizations to stay in collaboration, organizations are free to collaborate longer, or to quit. Morgan and Hunt [44] define “relationship commitment as an exchange partner’s believing that an on-going relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the committed party believes that the relationship is worth working on to ensure that it endures indefinitely.” In this study, commitment is defined as organization in transportation collaboration that believes that it will collaborate with others for a long time.

### 3.4. Trust

In this study, the author adopted the integrated model of trust in the e-commerce context proposed by McKnight, Vivek, and Charles [42]. This model is based on the theory of reasoned action (TRA) and the technology acceptance model (TAM) [22, 17]. In this model, trust has composite definitions which are (1) attitude (disposition to trust and institution-based trust), (2) trusting beliefs, (3) trusting intentions, and (4) trust-related behaviors. Trusting beliefs and trusting intentions are included in this study only because they are expected to change because of specific situations, such as trust in other organizations on a specific transportation collaboration project; but attitude is rather general. Thus, disposition to trust and institution-based trust are not expected to change after respondents are exposed to a specific IOS prototype, which is one of the study’s objectives.

Trust-related behavior is excluded because this study focuses on the formation stage of collaboration. McKnight, Vivek, and Charles [42] included three categories of trust beliefs:

- (1) competence (ability of the trustee to do what the truster needs),
- (2) benevolence (trustee caring and motivation to act in the truster’s interests), and
- (3) integrity (trustee honesty and promise keeping).

They identified two trusting intentions:

- (1) willingness to depend (volitional preparedness to make oneself vulnerable to the trustee), and
- (2) subjective probability of depending (the perceived likelihood that one will depend on the other).

Subjective probability of dependence is more concrete and more specific than willingness to depend, and is therefore selected for inclusion in this study. Since the stakeholders of this collaboration during the formation stage comprise the government agency and potential partners, this study includes trust in both government agencies and potential partners.

### 3.5. Prior Direct Alliance Experience

Prior direct alliance experience is one of the important sources of information about the competencies and needs of potential partners [24]. Most organizations collaborated with others in various activities, not limited to transportation. Prior direct alliance is defined here as earlier formal inter-organizational collaboration among organizations in transportation collaboration. This study also proposes preliminary hypotheses to test the relationships of these constructs. Direct prior alliance experience can provide information about potential partners that can increase trust during the formation stage [24].

**H1:** There is a positive relationship between direct prior alliance experience and trust in the potential partners in horizontal transportation collaboration during the formation stage.

Since there are different trust elements comprising trusting intention, competence, benevolence, and integrity, the following new set of sub-hypotheses are posited:

**H1a:** There is a positive relationship between direct prior alliance experience and *trusting intention* in potential partners in horizontal transportation collaboration during the formation stage.

**H1b:** There is a positive relationship between direct prior alliance experience and the *competence* of potential partners in horizontal transportation collaboration during the formation stage.

**H1c:** There is a positive relationship between direct prior alliance experience and *benevolence* of potential partners in horizontal transportation collaboration during formation stage.

**H1d:** There is a positive relationship between direct prior alliance experience and the *integrity* of potential partners in horizontal transportation collaboration during the formation stage.

As stated earlier, commitment and trust are central in relational exchange, and trust can increase relationship commitment [44]. Among the different elements of trust, only trusting intention is expected to increase collaboration commitment.

**H2:** There is a positive relationship between trusting intention and commitment in horizontal transportation collaboration during the formation stage.

A new set of research hypotheses can be generated from this research hypothesis for the two major stakeholders of this collaboration; namely, the government agency and potential partners.

**H2a:** There is a positive relationship between trusting intention in the *government agency* and commitment in horizontal transportation collaboration during the formation stage.

**H2b:** There is a positive relationship between trusting intention in *potential partners* and commitment in horizontal transportation collaboration during the formation stage.

In order to study the effects of IOS features on perceived truthworthiness among potential partners, the author developed an IOS prototype, using the guidelines discussed in section 2.3., “Designing IOS to Support Trust.”

**H3:** There is a positive difference in trust among potential partners before and after they are exposed to the IOS prototype.

In this study, every element of trust is expected to change after the respondents are exposed to the IOS prototype. A sub-set of research hypotheses are as follows:

**H3a:** There is a positive difference of *trusting intentions* among potential partners before and after they are exposed to the IOS prototype.

**H3b:** There is a positive difference of *competence* among potential partners before and after they are exposed to the IOS prototype.

**H3c:** There is a positive difference of *benevolence* among potential partners before and after they are exposed to the IOS prototype.

**H3d:** There is a positive difference of *integrity* among potential partners before and after they are exposed to the IOS prototype.

The success of collaboration constructs is excluded from this study because it is impossible to evaluate them during the formation stage.

#### **4. RESEARCH METHODOLOGY**

To test the hypotheses, one would need access to real data. However, since there was no actual horizontal transportation collaboration in Thailand during the data collection period, the author designed the data collection instrument by asking the respondents to assume that a transportation exchange is being formed. The survey method was then used to collect the needed data. Two sets of questionnaires were developed – one for pre-test and the other for post-test data collection. The pre-test questionnaire was for the third objective of this study, and the post-test was for the fourth objective. A paper-based IOS prototype was developed with a functional design aimed at raising trust. The prototype was shown to respondents before they answered the post-test questionnaire.

#### **4.1. Sample**

From a theoretical point of view, it would be desirable to question all the employees of an organization that is involved in transportation collaboration. This task, however, would make the data collection effort extremely complex. It was decided, therefore, that only one key informant (i.e., the logistics director) would be questioned per organization. This method is widely accepted and very typical for empirical research [4], as studies suggest that the information from different informants in one firm normally does not differ significantly if the informants are selected carefully [30]

There are two groups of participants: shippers and carriers. Third-party logistics (3PL) providers in one of the 3PL associations in Thailand were chosen as the target participants for the carrier group. Most organizations in the chosen associations offer services to the agricultural goods industry. Questionnaires were distributed to 50 or so organizations during the association's monthly meeting. Only 20 of the organizations returned the questionnaire.

For the shipper group, target participants were organizations that own trucks and transport their own goods. Purposive sampling was used to choose organizations from various industries in Thailand, including consumer products, textile, and construction. A total of 15 questionnaires were mailed out, and 11 were returned. Table 2 presents a profile of the respondents.

#### **4.2. Questionnaire Design**

The same questionnaires were used for both the shipper and carrier groups. Both groups were asked to complete two sets of questionnaires for pre-test and post-test data collection. The pre-test questionnaire begins with a statement of the research objective, questionnaire instructions, and a description of the collaboration model that would supposedly be established in each industry. Following were three sets of items: general information about organizations in the industry; transportation information; and questions about collaboration.

The post-test comprised items that address trusting beliefs and trusting intentions. The other questionnaire items are exactly the same as in the pre-test. Since the study was designed as a paper-and-pencil survey, the IOS prototype was shown by printing sample screens of the system onto paper. The prototype showed general features such as the use of GPS devices, and the menus included features expected to raise trust; namely, stable identity, traceability, and recording outcomes. Some features were shown on sample screens, and some were included in descriptive text.

#### **4.3. Measurement**

The following discussion covers transportation complementarity, perceived cost reduction, commitment, trust, and prior direct alliance experience.

**Table 2**  
**Profile of Respondents (N = 31)**

Item	Respondents <i>n</i> (%)
How long has your company been in your business?	
< 1 Year	1 (3.2)
1 - 5 Years	4 (12.9)
6 -10 Years	8 (25.8)
11 - 20 Years	12 (38.7)
21 - 50 Years	5 (16.1)
> 50 Years	1 (3.2)
What was your company previous year's turnover?	
< 10 million baht	7 (22.6)
10 -100 million baht	15 (48.4)
100 - 1000 million baht	6 (19.4)
> 1000 million baht	2 (6.5)
Not stated	1 (3.2)
Do your workers has basic knowledge about IT and Internet	
Yes	26 (83.9)
No	4 (12.9)
Not stated	1 (3.2)
How many percent of your truck's utilization nowadays?	
< 50%	3 (9.7)
50 - 60%	5 (16.1)
61 - 75%	6 (19.4)
76 - 90%	6 (19.4)
> 90%	7 (22.6)
Not stated	4 (12.9)

#### ***4.3.1. Transportation Complementarity***

Transportation complementarity was calculated using the definition presented earlier. This study developed a matching algorithm to calculate the transportation complementarity score. Organizations with transportation routes that are the same as others will have a high score. They might have an even higher score if their routes are in the opposite direction of others. The transportation route was measured by the amount of shipment travel between the starting point and the destination in each region.

#### ***4.3.2. Perceived Cost Reduction***

Perceived cost reduction was measured by an indicator that measures the perceived cost of net transportation cost reduction, minus the cost increase resulting from transportation collaboration if the organization were to join the project.

### 4.3.3. Commitment

Commitment was measured by four indicators modified from [39]. Seven indicators in the original measures are used for general inter-organizational commitment. This study included only the indicators applicable to transportation collaboration during the formation stage. These indicators were measured by a five-point Likert scale (1 = “strongly disagree,” and 5 = “strongly agree”). Following are the four indicators used to measure commitment in this study.

**Commitment1:** Our organization intends to invest in collaboration if it makes collaboration more effective.

**Commitment2:** Our organization will discontinue any search for alternative transportation collaboration if it decides to join the collaboration project.

**Commitment3:** Our organization is bound to our partners in the transportation collaboration for other future collaborations.

**Commitment4:** Our organization intends to join the project for a long time.

### 4.3.4. Trust

Trust was measured by 16 indicators modified from the work of McKnight, Vivek, and Charles [42]. The original measures were designed for trust in e-commerce. This study adapted two sets of measures for use in transportation collaboration via IOS: trust in the government agency, and trust in potential partners. Each set consists of eight indicators – six trusting beliefs measures, and two which are subjective probability of depending measures. Trusting beliefs comprise two indicators for each construct of competence, benevolence, and integrity. These were measured by a five-point Likert scale (1 = “strongly disagree,” and 5 = “strongly agree”). See Table 3.

**Table 3**  
**Indicators of Trust Used in This Study**

	Trust in Government agency		Trust in Potential Partner	
	Indicator 1	Indicator 2	Indicator 1	Indicator 2
Competence	Government agency is competent in supporting the collaboration	Government agency is competent in managing the collaboration	Transportation quality of others is good compared to yours	Other organizations are competent in collaborating with yours
Benevolence	Government agency will act in your organization's best interest	Government agency will honestly help if your organization need	Other organizations will never do opportunism behavior	Others will collaborates when problem and conflict occurs
Integrity	Government agency will manage as promises	Government agency will not change the rule frequently	Others will operate with high quality as promises	Other organizations would strictly follow rules
Intention	Our organization would confidently provide transportation information to government agency	Our organization would strictly follow rules from government agency	Our organization would confidently outsource transportation to others	Our organization would conveniently let others to meet our customers

#### 4.3.5. *Prior Direct Alliance Experience*

Prior direct alliance experience was measured by an indicator modified from Gulati and Gargiulo [24], which measures how often organizations directly collaborated with others a few years ago. A five-point Likert scale was used (1 = strongly disagree and 5 = strongly agree). The reliability of measurement was assessed by Cronbach's alpha if a construct is measured by multiple indicators. As shown in Table 4, the Cronbach's alpha coefficients for all constructs in the pre-test questionnaire are higher than 0.7.

**Table 4**  
**Cronbach's Alpha of Constructs**

<b>Construct</b>	<b>Cronbach's Alpha</b>
Commitment	0.762
Trusting Intention (Government Agency)	0.840
Trusting Intention (Other Organizations)	0.863
Competence (Government Agency)	0.868
Competence (Other Organizations)	0.718
Benevolence (Government Agency)	0.719
Benevolence (Other Organizations)	0.904
Integrity (Government Agency)	0.836
Integrity (Other Organizations)	0.860

## 5. HYPOTHESIS EXAMINATION AND RESULT ANALYSIS

Among the three sets of research hypotheses proposed, H1 and H2 can be tested simultaneously by the structure equation modeling (SEM) technique. This method, however, requires a large number of sample sizes, which is not applicable for the data in this study. Thus, the author used simple correlation and regression to test H1 and H2 separately. Also, the author used the paired-samples T-test to compare pre- and post-trust for testing H3. The average score was used to aggregate the score of each construct if more than one indicator was used.

Simple regression was used to test the relationship between direct prior alliance experience and various elements of trust in potential partners; namely, trusting intention (H1a), competence (H1b), benevolence (H1c), and integrity (H1d). Direct prior alliance experience was treated as an independent variable in H1a through H1d. With  $\alpha = 0.05$ , H1b, H1c, H1d are supported, whereas H1a are not. Table 5 shows the results of simple regression analyses for H1.

For H2, the author used multiple regressions to simultaneously test H2a and H2b. In H2a, the correlation between commitment and trusting intention in the government agency was tested whereas the correlation between commitment and trusting intention in potential partners was tested in H2b. The P-values of the regression coefficient are 0.385 for trusting intention of the government agency and 0.001 for other organizations. With  $\alpha = 0.05$ , only H2b is supported, but H1b is not. Table 6 shows the results of multiple-regression analysis in testing the H2 hypothesis.

**Table 5**  
**Results of Simple Regression Analysis for H1**

Research Hypothesis	Dependent Variable	Regression Coefficient ( $\beta$ )	R-Square	Adjusted R-Square	F value	P-value	Sample Size
H1a	Trusting Intention	0.155	0.026	-0.009	0.748	0.198	31
H1b	Competence	0.222	0.118	0.086	3.739	0.032*	31
H1c	Benevolence	0.372	0.264	0.237	9.709	0.002*	30
H1d	Integrity	0.254	0.135	0.103	4.228	0.025*	30

Independent variable = Direct prior alliance experience

**Table 6**  
**Results of Multiple-Regression Analysis for H2**

Research Hypothesis	Independent Variable	Regression Coefficient ( $\beta$ )	R-Square	Adjusted R-Square	F value	P-value	Sample Size
H2a	Trusting Intention in government agency	0.039	0.406	0.364	9.581	0.385	31
H2b	Trusting Intention in potential partners	0.412				0.001*	31

Dependent variable = Commitment

For H3, the author used the paired-samples T-test to compare the pre- and post-trusting scores. The analysis compared the mean between pre- and post- of various elements of trust in potential partners; namely, trusting intention (H3a), competence (H3b), benevolence (H3c), and integrity (H3d). With  $\alpha = 0.05$ , none

of the hypotheses were supported. There are slightly positive differences between pre- and post- exposed to the IOS prototype in H3a and H3c, but negative differences in H3b and H3d. Table 7 shows the results of the paired-sample T-test for H3.

**Table 7**  
**Results of Paired-Sample t-Test for H3**

Research Hypothesis	Variable	Mean (Post-Pre)	Std. Deviation	t	df	Sig. (2-tailed)	P-value
H3a	Trusting Intention	0.4839	0.43503	0.619	30	0.540	0.270
H3b	Competence	-0.17742	0.74776	-1.321	30	0.196	0.892
H3c	Benevolence	0.06667	0.55294	0.660	29	0.514	0.257
H3d	Integrity	-0.03333	0.58624	-0.311	29	0.758	0.879

Although some research hypotheses are supported by the present data, about half of them are not. To begin with, not all the sub-hypotheses for H1 are supported. The statistics from simple regression equations show that there are positive relationships between direct prior alliance experience and competence (H1b), benevolence (H1c), and integrity of potential partners (H1d), but not trusting intention in potential partners (H1a). One possible explanation is that trusting intention is more specific in transportation collaboration than are competence, benevolence, and integrity. Thus, information provided from prior alliances may not be enough for an organization to put trust in its potential partners in this specific transportation collaboration. In other words, only information about having a previous alliance is not sufficient to support trust. Other factors such as the actual experience (for example, good or bad) of such an alliance would be more useful in determining the trusting intention.

In H2, commitment was found to relate positively to trusting intention toward potential partners (H2b). With respect to a government agency, no statistically significant relationship was found between commitment and trusting intention (H2a). This may be because, in this transportation model, the government agency will support and manage the transportation collaboration for a short period at the beginning. The collaborating organizations will have to manage among themselves afterward. Thus, commitment – which is defined as intention to join the collaboration for a long time – does not depend on trust in the government agency.

Finally, none of the research hypotheses for H3 are supported. This result does not mean that the IOS being designed using the guidelines from literature

cannot be used to support the trust among collaborating organizations. However, the lack of relationship found in this research can be attributed to the limitations of the present research method. One reason is that the prototype used in this study was not interactive and only some sample screens were shown on a paper-based medium. Thus, the respondents might not have fully understood the function of the entire collaborative system. Another reason is that the respondents had only a short time to see the prototype (between the pre- and post-questionnaire). Without more explanation, they might not have recognized the features as suggested in the design guideline. These are limitations that future studies should address.

## **6. CONCLUSIONS**

The transportation collaboration model proposed in this study can help solve the empty truck problem and can also reduce transportation cost. Successful collaboration among organizations, however, is rare, especially when competitors are involved. This study contributes to the transportation collaboration literature and has many practical implications.

First, one of the questions that organizations usually want to know about collaboration with others is which criteria to use to select partners to join the collaboration. This study developed five partner selection criteria relevant during the formation stage of transportation collaboration, based on economic and social perspectives.

Second, this study discovered and explored IOS design factors regarding trust, based on trust warranting properties. Furthermore, the study formulated research hypotheses from a proposed conceptual framework. According to the results, direct prior alliance experience affects trusting beliefs, which are important to the success of transportation collaboration. Thus, an organization should give priority to selecting organizations with which it collaborated in the old days.

Third, study results show a positive relationship between trusting intention in potential partners and commitment in the transportation context, just as other researchers have done. Thus, organizations should also pay attention to trust in transportation collaboration.

Finally, this study empirically compared trust between respondents pre- and post- exposure to the IOS prototype. The results, however, do not support any research hypotheses.

There are some limitations in this study that should be addressed in future studies. First, there were no horizontal transportation collaboration projects in existence in Thailand during our data collection period. All were just at the formation stage of collaboration. Thus, this study could empirically collect data to test the relationship between the partner selection criteria of transportation collaboration and the actual outcome of the collaboration. Second, since this study collected data only from organizations in Thailand and used

non-probabilistic sampling, there is a limitation in generalizing the results. Third, without a sufficiently large sample, the relationship among constructs cannot be assessed simultaneously. Finally, the IOS prototype should be further developed and shown in an interactive style so as to emphasize features according to design guidelines.

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