

自製或外包：以貨櫃運輸公司為例

Outsourcing or Insourcing: The Case of Container Transport Company

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摘要

本研究採個案研究法，個案公司為全台灣最大的貨櫃運輸公司。實證結果發現採用作業基礎成本制度重新計算自有車輛與委外車輛的獲利表現後，自有車輛獲利下降幅度顯著大於委外車輛。然而，考量自車司機對於危險物品的運輸風險下降助益、以及結關日、連續假日前、週末運輸的大單配合度、都優於委外車行司機，顯示即使自有車輛獲利表現並不好，但仍有其存在之意義。

彙總而言，自有車輛及委外車輛存在之意義並不相同：前者是用來解決特殊運輸需求並且賺取特殊訂單的高額營收；然而，後者則是提升公司整體獲利表現。因此，自製或外包的決策管理必須同時考量財務及非財務因素。

關鍵詞：自有車輛、委外車輛、貨櫃運輸公司、作業基礎成本制度

Abstract

This study adopts the case study method. The Case Company is the largest container transport company in Taiwan. The empirical results show that after using activity-based costing to re-calculate the profitability of self-owned and outsourced vehicles, the profit declination magnitude of self-owned vehicles is significantly greater than that of outsourced vehicles. However, considering that the transportation risks of in-house drivers on hazardous goods would fall, and that the cooperativeness of in-house drivers on a clearance date or days before holidays and weekends is significantly superior to that of outsourced drivers, even if the profitability of self-owned vehicles are poor, there are reasons for them to exit.

In summary, the reason of maintaining self-owned vehicles and outsourced vehicles varies in that the former are helpful in solving special transportation requirements and earning higher prices from special orders, and the latter in enhancing the company's profit figures. Hence, managing the insourcing-outsourcing arrangement need to consider not only financial factors, but also non-financial factors.

Keywords: Self-owned Vehicle, Outsourced Vehicle, Container Transport Company, Activity-based Costing

1. Introduction

In today's thriving and prosperous commercial trade, corporate must use the sea, air or land transport mechanism to sell their goods or import raw materials, etc. Therefore, the transportation plays an extremely important role in corporate management. Therein, land transport is even an important part in transport mechanism as regardless of delivering goods to the port via sea transport or to the airport via air transport, it is still mandatory to deliver the goods to the sales locations or factories via land transport. Such trend has prompted a fast development of container transport companies.

The current Taiwan's corporate management pattern is dominated by export processing trade with a goal to make profits. So land transport is an indispensable element for the country's export trade. Until the end of 2013, there are a total of 557 container transporters in Taiwan. Despite a continuous growth of Taiwan's container transport industry, companies wishing to enter into this trade must meet certain capital expenditure requirements; i.e. a company must self-own 15 brand new trailers and more than 30 semi-trailers before it is eligible to establish as a container transporter, based on Taiwan's Ministry of Transportation Act. Therefore, the depreciation expenses, taxes and fuel costs are considerable burdens that the container transporters must bear. For the container transporters to cope with customer growing needs on transportation and reduce their own expenses, their current most common solution is to coordinate with peer transport companies to co-handle the haulage and fulfill the customer transportation needs. Such practice is ideal to solve sudden mass customer transportation needs, and avoid increasing equipment costs, unused haulage capacity and other factors not conducive to business. As far as container transport industry is concerned, other than self-owned transport vehicles, commissioning the haulage to peer companies to fulfill the delivery tasks altogether has already become the industry's operation norm.

In the United States, logistics costs account for about 12% of the nation's GNP. Furthermore, for a single product, every \$1 dollar of sales amount contains an average of \$0.21 dollar logistics costs (Yang, 2002). Among logistics costs, container transport costs account for about 60%; therefore, handling container

transport costs is very important. Unfortunately, no authoritative figures are currently available regarding the percentage of domestic logistics costs to GNP; however, according to the estimation of the Directorate-General of Budget, Accounting, and Statistics (DGBAS), domestic logistics costs account for at least 15% of GNP. Therefore, this study aims to investigate the outsourcing and insourcing decisions of container transport companies. The Case Company of this study is a Taiwan's listed container transport company that owns a total of 255 trailers. Despite owning such a large fleet, the Case Company is still unable to meet with customer transportation needs. To avoid high costs caused by unused haulage capacity, the Case Company has currently coordinated with peer companies to co-handle the haulage. Considering the corporate profits, each regional dispatcher has developed the income statement of self-owned/outsourced vehicles to serve as a management guide. Such transportation statement has thus played a relatively important role in self-owned/outsourced transportation strategy for Case Company.

However, the Case Company's transportation system is only used in vehicle dispatching and has yet been interlinked with the accounting system. So many data on income statement cannot be calculated and statistically analyzed by the computer, but calculated manually by the dispatcher. As the Case Company's non-attributable overhead costs are still being self-determined on an allocating benchmark of self-owned/outsourced vehicle revenue proportion, this has resulted in serious distortion in transportation income statement of self-owned/outsourced vehicles. In view of this, the first purpose of this study is to recalculate the non-attributable overhead costs by activity-based costing in order to help Case Company's managers make more accurate self-owned/outsourced vehicle arrangement decision. In other words, if a company cannot accurately calculate costs, it will make erroneous decisions and suffer additional losses from wrong pricing (Cooper & Kaplan, 1988, 1992; Kaplan, 1989). The activity-based costing, which has been proposed as a means of overcoming the flaws of traditional costing, uses various drivers (including volume-related allocation bases and non-volume-related allocation bases) to allocate costs. This is expected to improve the accuracy of transportation cost calculations and to lead to an increase in the appropriateness of management decisions.

Relevant information refers to information that makes a difference between different decisions. Relevant information, which does not necessarily appear in the financial statements, includes both quantitative information and qualitative information (Morse et al., 2002). Therefore, in this paper, I consider both relevant quantitative and qualitative information about outsourcing and insourcing decisions of container transport companies. The first purpose of my study is to recalculate the non-attributable overhead costs by activity-based costing in order to help Case Company's managers make more accurate outsourcing and insourcing decision through quantitative relevance information. Although the dispatcher and manager can perform profitability analysis using the income statement of self-owned/outsourced vehicle, but they also have to face with relevance qualitative information, such as transportation risks and other considering factors while outsourcing the haulage to peer vehicle transport companies, for example operation financial risks of the outsourced companies (the most severe being bankruptcy), or high complexity of transport operations (haulage of high-priced, hazardous or fragile goods). To avoid failure in haulage coordination and liquidated damages caused by the bankruptcy of outsourced container transport companies, or the company's compensation loss or reputation loss caused by transportation safety accidents, so a second research purpose was proposed by this study is to explore whether or not transportation risks would affect the self-owned/outsourced vehicle management strategy.

Furthermore, considering the timeliness of trade when certain goods are urgently needed by a customer to ease production, or the goods have to be exported and sold immediately, they must be delivered successfully within the date as specified in the contract after the company has signed the transportation pact with this customer. So drivers working overtime during holidays or weekends have become a transportation norm for the container transport companies. In other words, if the dispatcher has secured orders but has no vehicle to fulfill the haulage, this would not only affect the company's revenues, but also cause adverse impact to business growth due to the breach of contracts, reputation loss or customer loss. If drivers can work overtime to fulfill the haulage demands cooperatively, it would be profitable for the corporate in face of sudden large haulage needs, in particularly on

clearance date. Hence, a third research purpose is to consider whether or not the driver's cooperativeness would affect the company's self-owned/outsourced vehicle management strategy.

In summary, the Case Company's profit distortion of self-owned/outsourced vehicles was generated by the dispatcher trying to achieve the company's predetermined self-owned vehicle profits to avoid the business manager from being accused by the shareholders, thus using the self-owned/outsourced vehicle revenue proportion as cost-allocating benchmark for non-attributable overhead costs. So the activity-based costing was firstly used by this study to re-allocate non-attributable overhead costs in order to find out a more accurate profit on self-owned/outsourced vehicles. In addition, after considering the transportation risks and cooperativeness, whether or not "profitability" is the only consideration taken by the company's self-owned/outsourced vehicle strategy is a follow-up issue that this study will do. From the empirical results, the study found that: through the more accurate cost-allocating benchmark of activity-based costing, the profit gained from self-owned vehicles has substantially declined. However, after taking transportation risks and cooperativeness in consideration, even if self-owned vehicles have generated losses, the company must still maintain the vehicles as their existence is able to reduce transportation risks and improve cooperativeness.

There are three categories of motivations for outsourcing: cost, strategy, and politics (Kakabadse & Kakabadse, 2000). Much of the literature identifies "saving costs" as an explanation for why outsourcing occurs (Bergsman, 1994; Willcocks et al., 1995; Aubert et al., 1996; Kriss, 1996; Brandes et al., 1997; Bienstock & Mentzer, 1999; Vining & Globerman, 1999; Arnold, 2000; Fan, 2000; Laarhoven et al., 2000; Kremic et al., 2006). Although companies may outsource for cost related reasons, there are no guarantee that savings have been realized (Kremic et al., 2006). On the contrary, there is an increasing evidence that expected savings have been overestimated and total costs are sometimes higher before outsourcing (Welch & Nayak, 1992; Pepper, 1996; Bryce & Useem, 1998; Cole-Gomolski, 1998; Vining & Globerman, 1999; Kremic et al., 2006) because additional indirect and social costs may be incurred (Gillett, 1994; Maltz & Ellram, 1997). Among them, social costs means the costs arise from outsourcing, for instance: outsourcing may result in low

moral, high absenteeism, lower productivity, etc. (Eisele, 1994; Walsh, 1996; Kakabadse & Kakabadse, 2000; Kremic et al., 2006). To summarize, the literature indicates that the desire for cost savings may drive outsourcing initiatives; however, the studies also assert cost savings are not a given. Apparently the effects of outsourcing on a company's costs, especially social costs are not yet fully understood, and perhaps the variables and their relationships are more complicated than expected. Therefore, this study uses activity-based costing to re-allocate non-attributable overhead costs in order to find out a more accurate profit on self-owned/outsourced vehicles. In addition, after considering social costs, such as: the transportation risks and cooperativeness, whether or not "profitability" is the only consideration taken by the company's self-owned/outsourced vehicle strategy is a follow-up issue. The findings can serve as a reference for the transport industry, either using self-owned vehicles in transportation or outsourcing the haulage. It can also make up the gap in literature.

2. Literature Review and Outsourcing-Insourcing Decision

2.1. The Effect of the Activity-based Costing on the Outsourcing-Insourcing Decision

Kaplan & Cooper (1998) have identified the ABC method's effects on management decision. In the traditional costing system, direct labor hours or direct labor costs are often used as the base for allocating indirect costs and support costs. However, because indirect costs and support costs are very weakly correlated with direct labor, the use of the traditional costing system often leads to an inaccurate assessment of costs (Tai et al., 2012); this leads to an erroneous management decision. However, a company can correctly attribute indirect costs and support costs to cost objects under ABC using resource drivers and activity drivers. I define container transportation outsourcing or insourcing as two confronting products; therefore, choosing outsourcing or insourcing is one kind of product-mix decision. Lea & Fredendall (2002) and Tai et al. (2012) all asserted that the effects of a

product-mix decision model based on ABC are superior to the traditional costing system. In addition, Sievanen et al. (2004) used a case study method to substitute numbers from a real case into the ABC system. Moreover, Kee (1995) found that ABC could produce a more profitable product-mix decision model than the TOC when capacity costs are taken into account.

From the studies mentioned above, because ABC attributes costs based on activity drivers and resource drivers, it can produce a more accurate product-mix than the traditional costing system. Furthermore, except to acquisition costs, self-owned vehicles also have to bear follow-up maintenance costs, depreciation costs, fuel costs and taxes. In addition to, the company also needs the Finance Department to assess, calculate and distribute driver wages and incentives; and the Human Resource Department to perform educational training, insurance, pension and other expenses. Such aforesaid costs are not necessary for outsourced vehicles. So this study expects that after the company has changed to use the activity-based costing and can correctly attribute indirect costs and support costs to cost objects using resource drivers and activity drivers, the profit declining magnitude on self-owned vehicles will be larger than that of outsourced vehicles.

2.2. The Effect of the Transportation Risks on the Outsourcing-Insourcing Decision

Following Chase et al. (2004), the decision process of outsourcing is defined as “act of moving some of a firm’s internal activities and decision responsibilities to outside providers”. Lankford & Parsa (1999) also indicated the similar opinion. In other words, the basic outsourcing concept is reallocating production, including service or manufacturing capacity from one location to another. Outsourcing can let firms focus on core activities (Pagnoncelli, 1993; Antonucci et al., 1998; Lankford & Parsa, 1999; Yang & Huang, 2000; Beaumont & Costa, 2002; Schniederjans & Zuckweiler, 2004) and lower overhead costs (Gupta & Gupta, 1992; Pagnoncelli, 1993; Antonucci et al., 1998; Lankford & Parsa, 1999; Yang & Huang, 2000; Beaumont & Costa, 2002). Moreover, outsourcing can transfer fixed costs into variable costs (Allnoch, 1997; Antonucci et al., 1998; Yang & Huang, 2000; Beaumont & Costa, 2002).

On the contrary, outsourcing will lose control over critical functions (Gupta & Gupta, 1992; Apte et al., 1997; Antonucci et al., 1998; Lankford & Parsa, 1999), for instance: a less control of suppliers (Allen et al., 2001). In other words, for enterprises, the main purposes of outsourcing are to increase production flexibility, and avoid the dilemma of unable to deliver the goods for orders that have been secured. For the outsourced vendors, what they need are long-term and stable orders to favor business development. However, they have to pre-invest on equipment to satisfy customer high demands, but may face with a cash flow reduction whenever there is a decrease in production need. And as they have already invested a lot in equipment costs, they will have a significant chance of experiencing the financial risks (Hakansson & wootz, 1979; Valla, 1982). On the other hand, as “transport” is the key business of the container transport companies and that drivers are first-line service personnel, so choosing drivers with familiar operating procedures and professional licenses are more appropriate for the freight companies in face of high-risk or more complex transportation procedures (Valla, 1982).

Furthermore, the company can only clearly understand its own financial risks but not the cash flow issue of outsourced companies, thus resulting in poor control over their financial risks. In addition, due to the complex transport operation of hazardous goods, the vehicles must conduct relevant modifications and the drivers must comply with professional training to obtain the relevant licenses. Meanwhile, large training and equipment expenses invested in transporting hazardous goods will result in relatively high remuneration returns. This may generate significant revenue increases for the company though, but the dispatcher must be very careful while dispatching the vehicles to avoid the company from paying the compensation costs. Furthermore, after taking cost factor into consideration, the possibility for outsourced vehicles to coordinate in vehicle modification or driver education to obtain relevant licenses to deliver hazardous goods is slim. Such financial risks of outsourced vehicles and transportation risks while delivering hazardous goods are collectively known as transportation risks by this study. Based on the aforesaid discussion, I propose: after taking transportation risks into consideration, the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage.

2.3. The Effect of the Cooperativeness on the Outsourcing-Insourcing Decision¹

Container transportation outsourcing will make the company is dependence on suppliers (Gupta & Gupta, 1992; Pagnoncelli, 1993; Antonucci et al., 1998; Beaumont & Costa, 2002) and lose control over quality of suppliers' work (Allnoch, 1997; Apte et al., 1997; Beaumont & Costa, 2002). Furthermore, the lower morale of outsourcing drivers than insourcing drivers. This means that the level of cooperation of insourcing drivers is higher than that of outsourcing driver (Gupta & Gupta, 1992; Antonucci et al., 1998; Lankford & Parsa, 1999; Elmuti & Kathawala, 2000; Beaumont & Costa, 2002). On the other hand, the competitive advantages of transport service lie in the capability of meeting customer time requirements, especially on clearance date or days before holidays, or on weekends. To avoid import/export delay of goods caused by relevant personnel leaves, overtime is often needed to cope with increasing workloads. Therefore, satisfying customer time is the first priority while dispatching self-owned or outsourced vehicles.

However, as the outsourced truck drivers are not the company's employees, they tend to coordinate with the company poorly (Gupta & Gupta, 1992; Antonucci et al., 1998; Lankford & Parsa, 1999; Beaumont & Costa, 2002). In other words, they will not coordinate well with the company when faced with large orders and a need to work overtime to engage in more delivering trips to meet with customer demands. Furthermore, if the outsourced delivery prices are far beyond expected by the outsourced drivers, and that prices for other delivery works are better, they will reflect with poor cooperative willingness.

In summary, although the outsourced haulage can undoubtedly allow the company to reduce transportation costs and increase profits, but when faced with large orders, such as clearance day and days before weekends, many customers

¹ The information system of the Case Company's outsourced vehicle companies lags far behind that of electronics industries' outsourcers; for example, they lack GPS systems or other imported information systems. Furthermore, overtime payment is issued in the following month, so problems with computing overtime payments in this month can occur. Furthermore, the overtime payment may occasionally change into performance bonuses; therefore, using dimensions of costs or pricing to consider cooperativeness on the outsourcing-insourcing decision of the Case Company is currently not feasible.

would request the relevant personnel to finish the delivery on Friday as to avoid them from taking leaves and refusing to deliver. At such, the dispatcher must fulfill the customer transportation needs to avoid liquidated damages. Therefore, it is a top priority for the dispatcher to find cooperative transport drivers. The study asserts that after taking outsourced vehicle cooperativeness into account, the company's possibility in choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage.

3. Research Design and Overview of the Case Study Company

This study investigates issues pertaining to a corporation's internal management, such as how to make outsourcing and insourcing decisions, which factors to consider while making these decisions, why these factors are important, and how they are considered in actuality. Therefore, conducting a large-scale questionnaire survey is not an appropriate method. In order to understand the actual operation of a corporation's internal management system in detail, it is necessary to use the case study method (Bruns & Kaplan, 1987; Yin, 2003; Ge & Ding, 2008; Tai et al., 2012; Lin & Kang, 2014). In accordance with this view, this study adopts the case study method in order to understand the outsourcing-insourcing decision process in a container transport company.

Company S is chosen as the Case Company. The Case Company was founded in Taipei in 1976, the key initial business operation of the Case Company was container transports. In addition, to meet with customer needs in import/export trades at the port, it later established transportation bases in Keelung, Ilan, Taichung, Kaohsiung and Taoyuan regions. Besides the island's container transport business, it has gradually increased the import/export trades, container transshipment and other services. To cope with the striving transportation orders, its regional bases have set up vehicle repairing and inspection operations to serve in-house and external vehicles, which have simultaneously increased its revenues greatly. To summarize, Company S is a Taiwan's leading listed company in the container transport industry, the company registered a total asset of about US\$150 million and a total revenue of

about US\$560 million in 2014. To spearhead in the industry, besides providing customers with comprehensive transport services, Company S also offers customs services. The diversified range of transport services of this enterprise has helped it to avoid idle costs. Because Case Company is unable to meet with customer transportation needs, it has cooperated with other transport companies capable of offering good quality services, allowing it to dispatch vehicles flexibly to avoid idle costs. For such company, its core operating strategy is a sort of insourcing/outsourcing transport operation. Therefore, Company S appears suitable for our case study.

In addition, in face of gradual fuel cost increases in recent 10 years, the company regional bases have also set up gas stations on their owns to favor dispatching and reducing oil consumption losses, and avoiding empty trips and transportation losses. The external services of gas stations have also increased the company revenues. Moreover, to cope with customer needs in distributing imported goods to the sales locations, it has also set up logistics and warehousing units to facilitate customers in distributing and storing the commodities. Furthermore, as the import/export trades also need to rely on declarations and shipping operations, it has further set up declaration and shipping operations in each business base after taking customer conveniences and the company's revenue growth into account. So far, the company has fully integrated its transportation advantages to lead in the country in terms of transportation business volume.

The company's current business operations are as follows:

1. Import/export container businesses: Current establishment of transporting 20-foot and 40-foot containers.
2. Domestic bulk transports: Provides transportation services on pallet and hazardous goods, such as chemical tanks, fragile goods, and commodities of irregular masses.
3. Dumping/unloading business: Acquisition of dump trucks to ease transporting. Such business is mainly done at the ports during night times or holidays.
4. Vehicle repairing business: Provides timely vehicle maintenance to ease dispatch transporting, and vehicle inspection to meet with transportation laws and regulations.

5. Warehousing business: Provides storage and distribution of customer goods.
6. Customs and shipping services: Helps customers to deal with import/export tax tariffs and exports goods to foreign countries following the liner schedules.
7. Logistics business: Delivers customer goods to the sales locations, such as shopping malls or general retail stores.
8. Gas stations: Provides fuel for self-owned and external vehicles, being currently regarded as a business with highest revenues.

However, the Company S's transport operating system is only used in vehicle dispatching and has yet been interlinked with the accounting system, thus resulting in many data on the transportation income statement cannot be calculated and statistically analyzed by the computer. For example: the cost-allocating method for non-attributable overhead costs is self-determined to use the revenue proportion of self-owned/outsourced vehicles. This has resulted in serious distortion in transportation income statement of self-owned/outsourced vehicles. In addition, when the Accounting Department is requested by the high-ranking manager to bring out profitable improvement plans of self-owned/outsourced vehicles, the department is unable to bring forward effective proposals due to the self-manipulated transportation income statement and unreasonable allocation basis. In view of this, this study intends to re-allocate non-attributable overhead costs through activity-based costing to ease the manager in making more accurate self-owned/outsourced vehicle management strategy out of the transportation income statement. Furthermore, as considering the transportation risks and cooperativeness, whether or not "profitability" is the only consideration taken by the Case Company is a follow-up issue that this study will do.

The information collection procedure is described as follows. On-site interviews were conducted, and related documents and information were collected and studied. The interviewed subjects were the director-general, an associate manager of dispatch, and an accounting manager. Ten interviews were held, and the average length of a session was four hours. There were five additional sessions of phone interviews and fact confirmations. Finally, responses from different interviewees were crosschecked and confirmed to ensure the objectivity and reliability of the collected information.

4. The Outsourcing-Insourcing Decision with Activity-Based Costing

4.1. The Outsourcing-Insourcing Decision before Re-calculation with Activity-Based Costing

The Case Company's regional operating bases have all established three units of business, dispatching and management. Therein, the Business Department is responsible for seeking and providing the required services for customer orders; the Dispatching Department providing self-owned or outsourced haulage services; and the Management Department offering vehicle maintenance, driver recruitment, incident handling, etc. At present, the Case Company has a total of 255 self-owned vehicles to carry out the haulage services. As such transportation service may require pallet and dump truck loading, the Case Company has acquired some 500 transport pallets to cope with customer transportation needs. To avoid dispatching problems for large numbers of customers, the regional operating bases have also signed contracts with other transport companies to engage in outsourced delivery services to avoid default risks caused by untimely dispatching.

Amid the advances in science and technology, and to allow customers to receive more convenient services, the company has implemented full computerized operation in all regional operating bases. The aims are to reduce costs in time and space transports through interconnecting network with external enterprises, thereby helping customers to place direct orders, specify the container arrival time and inquire the vehicle dynamic status though the computer network.

The regional transportation income statement is divided into two types: self-owned and outsourced vehicle income statements. After analyzing the 2014 north regional transportation income statement of Case Company, the study has discovered that: to avoid higher overhead costs of self-owned vehicles that would result in poor performance and be blamed and questioned by the enterprise's high-ranking officers and shareholders, the company's departmental manager has used the self-manipulated allocating benchmark to allocate non-attributable overhead costs. Currently, two modes are adopted by the transportation income statement of

self-owned and outsourced vehicles. The first is direct attribution, and the second is self-determination of using revenues proportion as the allocating benchmark. The descriptions are as follows:

1. Direct attribution: To attribute the expenses directly to self-owned vehicles or outsourced vehicle profit center as shown in the table 1.
2. Self-determination of using revenues proportion as the allocating benchmark: In addition to the aforesaid direct-attributable expenses, the self-owned and outsourced vehicle revenue proportion is adopted to serve as the allocating benchmark. The allocating mode is shown in the table 2.

However, as self-determination of revenue proportion is taken as the cost-allocating basis of non-attributable overhead costs, it has resulted in serious distortion of transportation income statement of self-owned and outsourced vehicles. Furthermore, as the cost-allocating basis is not performed according to cost drivers, so the high-ranking executives cannot be effectively provided with cost improvement proposals. In view of this, the non-attributable overhead costs was firstly re-allocated by the study to use activity-based costing in helping the company manager to make more accurate self-owned and outsourced vehicle dispatching strategy based on the transportation income statement.

Table 1 The Case Company’s direct attribution costs

Cost Category	Mode	Profit Center
1. Outsourced vehicle freight costs	Direct attribution	Outsourced vehicles
2. Outsourced vehicle miscellaneous costs		Outsourced vehicles
3. Self-owned vehicle driver personnel costs		Self-owned vehicles
4. Self-owned vehicle maintenance, taxes and fuel costs		Self-owned vehicles
5. Self-owned vehicle insurance		Self-owned vehicles
6. Self-owned vehicle depreciation and depletion costs		Self-owned vehicles
7. Miscellaneous acquisition costs		Self-owned vehicles and Outsourced vehicles
8. Operating expenses		Self-owned vehicles

Source of data: Case Company provided.

Table 2 Costs allocated by self-determination revenues proportion

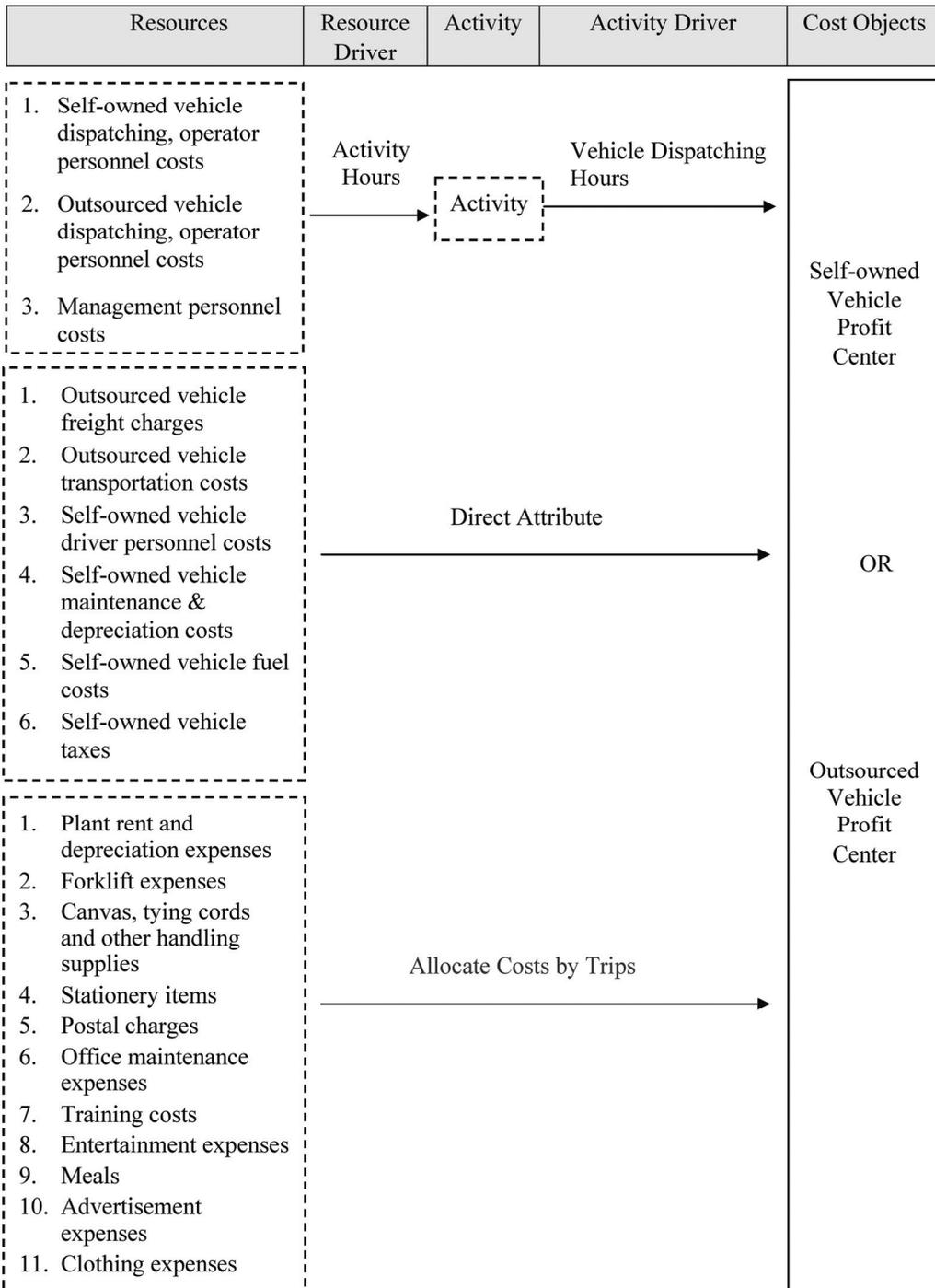
Cost Category	Mode	Profit Center
1. Management personnel costs	Revenues proportion	Self-owned vehicles and Outsourced vehicles
2. Commission charges		
3. Travel expenses		
4. Stationery expenses		
5. Mail/electricity expenses		
6. Office maintenance expenses		
7. Entertainment expenses		
8. Training expenses		
9. Books and magazines expenses		
10. Conference expenses		
11. Meal expenses		
12. Clothing expenses		
13. Advertisement expenses		
14. Other costs		

Source of data: Case Company provided.

4.2. Activity-Based Costing Structure

This study uses the activity-based costing shown in Table 3 to re-calculate the profit of self-owned and outsourced vehicles. Firstly, the resources have been divided into three major parts: one part of which calculates the cost of each activity through the resource driver and then allocates the activity costs to the cost objects through the activity driver; another part attributes the costs directly to the profit center of self-owned or outsourced vehicles; and the last part allocates costs to the self-owned or outsourced vehicle profit center by trips. From the recalculated income statement of self-owned and outsourced vehicles based on the activity-based costing, it points out that the declining magnitude of self-owned vehicles is significantly greater than that of outsourced vehicles. This hints that the company's original transportation income calculation method will indeed result in profit distortion.

Table 3 The Case Company's activity-based costing structure



Source of data: compiled by author.

5. Analysis Results

The self-owned vehicle profit center and outsourced vehicle profit center are independent cost centers that do not interfere with each other. Whether choosing self-owned or outsourced vehicles to perform the haulage service, the dispatcher only considers whether or not the driver's experience and vehicle status comply with regulations. As a result, as long as the drivers possess the required experience and licenses, the differences between self-owned or outsourced vehicles will not affect the dispatcher's decision. Therefore, the samples used in this study can meet the conditions of independent events, i.e., no interactive impacts will occur among the samples. Furthermore, if the differences between the mean of a certain sample and that of another sample need to be examined, then the t-test is the appropriate method. Thus, I expect to use the t-test in this study.

5.1 The Effect of the Activity-based Costing on the Outsourcing-Insourcing Decision

This research analyzed the 2014 north regional monthly transportation income statement of the Case Company, so the self-owned vehicles group and the outsourced vehicles group both have 12 samples. This study defines profit declining magnitude as the profit number calculated by the Case Company minus the profit number calculated by activity-based costing. Furthermore, the assumption of using the t-test to examine the differences between the mean of the two groups is normality. According to Maddala (2000), I run a Shapiro-Wilk test to acquire W value. The W value of the self-owned vehicles and outsourced vehicles groups is 0.872 ($p > 10\%$) and 0.934 ($p > 10\%$), respectively; therefore, the results do not reject the samples of the two groups are normality, and using t-test in this study to examine the differences between the mean of the two groups is thus suitable.

Levene's test (Levene, 1960) is used to test if samples have equal variances. Equal variances across samples is called homogeneity of variance. Levene's test can be used to verify an assumption. Two types of t-test can be performed: one in which

samples have equal variances and the other in which samples have unequal variances. Therefore, I first have to run Levene’s test to check whether the variance of samples is equal. The F value of Levene’s test is 72.215 ($p < 1\%$); therefore, I reject the null hypothesis because the variance of samples is unequal. Then I use the t-test assuming the unequal variances of samples. As shown in Table 4, the findings reveal that after using the activity-based costing, the profit declining magnitude of the self-owned vehicles group is greater than that of the outsourced vehicles group ($t = 12.246$, $p < 1\%$); therefore, the empirical results support my assertion: after using activity-based costing, the profit declining magnitude of self-owned vehicles will be greater than that of outsourced vehicles.

Table 4 The empirical result of the effect of the activity-based costing on the outsourcing-insourcing decision

Profit Declining Magnitude ¹	Mean	Standard Error	N	t value	p value
Self-owned Vehicles	476,484	132,186.439	12		
Outsourced Vehicles	-1,727,142 ²	105,802.340	12		
Differences	2,203,626	26,384.099		12.246	< .0001

Note : ¹ This study defines profit declining magnitude as the profit number calculated by the Case Company minus the profit number calculated by activity-based costing.

² After using activity-based costing, the profit declining magnitude of outsourced vehicles is negative, meaning the profit number of outsourced vehicles is larger.

Source of data: compiled by author.

5.2 The Effect of the Transportation Risks on the Outsourcing-Insourcing Decision

In section 2.2, I propose that after taking transportation risks into consideration, the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage. In order to test my assertion, I define two groups: the delivering hazardous goods group and the delivering normal goods group. I define the delivering trip difference magnitude as the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles. I then compare the delivering trip difference magnitude of the two groups to investigate, after considering transportation risks, whether the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage. The Case Company prepares a transportation statement of delivering hazardous goods each month and a transportation statement of delivering normal goods every day; therefore, in order to compare two groups, I sum the trip of delivering normal goods by month. Then, the delivering hazardous goods group and the delivering normal goods group both have 12 samples. As previously mentioned, the assumption of using the t-test to examine the differences between the mean of two groups is normality, and following Maddala (2000), I run the Shapiro-Wilk tests to acquire the W value of two groups. The W value of the delivering hazardous goods group and the delivering normal goods group is 0.850 ($p > 10\%$) and 0.412 ($p > 10\%$), respectively; therefore, the results do not reject the samples of the two groups are normality, and using the t-test in this study to check the differences between the mean of the two groups is appropriate.

Next, I use Levene's test to check whether the variance of samples is equal or not. The F value of Levene's test is 1.513 ($p > 10\%$); therefore, I don't reject the null hypothesis because the variance of samples is equal. Then I use the t-test assuming equal variances of the samples. The results of Table 5 show that the delivering trip difference magnitude of delivering hazardous goods is greater than that of delivering normal goods ($t = 2.018$, $p = 0.028$). Thus, the findings support my suggestion: after taking transportation risks into consideration, the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage.

Table 5 The empirical result of the effect of the transportation risks on the outsourcing-insourcing decision

Delivering Trip Difference Magnitude ¹	Mean	Standard Error	N	t value	p value
Delivering hazardous goods	1,158	551.218	12		
Delivering normal goods	590	805.224	12		
Differences	568	254.006		2.018	0.028

Note : ¹ Delivering trip difference magnitude means the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles.

Source of data: compiled by author.

5.3 The Effect of the Cooperativeness on the Outsourcing-Insourcing Decision

In section 2.3, I propose after taking cooperativeness into consideration, the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage. In order to test my assertion, I employ two tests. In the first test, I define two groups: the delivering on a normal date group and the delivering on a clearance date or days before holidays group. I define delivering trip difference magnitude as the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles. Next, I compare the delivering trip difference magnitude of the two groups to investigate whether the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage. Following the same concept, in the second test, I define two groups: the delivering on non-weekends group and the delivering on weekends group. Then, I define delivering trip difference magnitude as the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles, and I compare the delivering trip difference magnitude of the two groups to investigate whether the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage. The Case Company prepares a transportation statement of delivering goods on weekends or

on non-weekends each month, and a transportation statement of delivering goods on a clearance date or days before holidays group, or on a normal date every day; therefore, the samples of delivering on a clearance date or days before holidays group, on a normal date group, on weekends group, and on non-weekends group is 58, 302, 12 and 12, respectively. As previously mentioned, the assumption of using the t-test to examine the differences between the mean of the two groups is normality, so I run the Kolmogorov-Smirnov test and Shapiro-Wilk test to acquire the D value and W value. The D value of the delivering on a clearance date or days before holidays group, and on a normal date group is 0.227 ($p > 10\%$) and 0.295 ($p > 10\%$). In addition, the W value of the delivering on weekends group, and on non-weekends group is 0.298 ($p > 10\%$) and 0.324 ($p > 10\%$). Therefore, the results do not reject the samples of the four groups are normality. Thus, using the t-test in this study to examine the differences between the mean of groups is suitable.

Then I run Levene's test to check the equality of variances of Test I and Test II. The F value of Levene's test of Test I is 1.395 ($p > 10\%$); therefore, I do not reject the null hypothesis because the variance of samples is equal. Then I use t-test assuming the equal variances of samples. Table 6 reveals that the delivering trip difference magnitude of delivering on a clearance date or days before holidays is greater than that of delivering on a normal date ($t = 2.594$, $p < 1\%$), which supports my expectation.

In addition, The F value of Levene's test of Test II is 23.629 ($p < 1\%$); therefore, I reject the null hypothesis because the variance of samples is unequal. Then I use t-test assuming the unequal variances of samples. Table 7 reveals that the delivering trip difference magnitude of delivering on weekends is greater than that of delivering on non-weekends ($t = 3.703$, $p < 1\%$), which also supports my expectation. To sum up, Test I and Test II both assert after taking cooperativeness into consideration, the possibility of choosing self-owned vehicle haulage is greater than that of outsourced vehicle haulage.

Table 6 The Empirical Result of the Effect of the Cooperativeness on the Outsourcing-Insourcing Decision-Test I

Delivering Trip Difference Magnitude ¹	Mean	Standard Error	N	t value	p value
Delivering on a clearance date or days before holidays	99	17.643	58		
Delivering on a normal date	54	6.526	302		
Differences	45	11.117		2.594	0.005

Note :¹Delivering trip difference magnitude means the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles.

Source of data: compiled by author.

Table 7 The Empirical Result of the Effect of the Cooperativeness on the Outsourcing-Insourcing Decision-Test II

Delivering Trip Difference Magnitude ¹	Mean	Standard Error	N	t value	p value
Delivering on weekends	61	43.096	12		
Delivering on non-weekends	15	8.415	12		
Differences	46	34.681		3.703	0.003

Note :¹Delivering trip difference magnitude means the delivering trips of self-owned vehicles minus the delivering trips of outsourced vehicles.

Source of data: compiled by author.

6. Conclusions

Outsourcing is promoted as one of the most power trends in resources management. The reasons for outsourcing functions including costs savings, an increased ability to focus on strategic issues, access to technology and specialized expertise, and an ability to demand measurable and improved service levels

(Belcourt, 2006). However, these benefits are not always be realized. Moreover, there may be an impact on employee moral and operation risk. For the container transport industry, the selection of self-owned and outsourced vehicles is a core issue. In this study, a Taiwan's largest container transport company was chosen as the Case Company in an attempt to explore whether or not profitability is the only consideration while choosing self-owned and outsourced vehicles? The empirical results show that after recalculating with activity-based costing, the profit declination magnitude of self-owned vehicles is significantly greater than that of outsourced vehicles. It can be seen that if the Case Company's income statement of self-owned vehicles has not been self-manipulated, its profit performance will not be good. However, considering that the transportation risks of in-house drivers on hazardous goods would fall, and that the cooperativeness of in-house drivers on a clearance date or days before holidays and weekends is significantly superior to that of outsourced drivers, even if the profitability of self-owned vehicles are poor, there are reasons for them to exit. The purposes are to ease vehicle dispatching under special occasions after considering the compensation charges caused by faulty delivery of hazardous goods, and the dilemmas of customer loss and corporate revenue stall caused by reputation damage or inability to cope with large orders and urgent orders.

In short, under the premise of company manager attempting to enhance the corporate profits, it is a good solution to expand the cooperative operation to outsourced vehicle companies in the short term. However, considering the avoidable costs for self-owned vehicles, such as: follow-up maintenance costs, depreciation costs and taxes, the Case Company needs more information while making outsourcing-insourcing decision in the long term. On the other hand, in the event of increasing trips to transport hazardous goods or larger transportation demands during the clearance date or on weekends, it is essential to own in-house drivers to avoid customer loss caused by no vehicle to deliver the goods. In summary, the significance of maintaining self-owned vehicles and outsourced vehicles varies in that the former are helpful in solving special transportation requirements and earning higher prices from special orders, and the latter in enhancing the company's profit figures. For example: the revenues earned by self-owned vehicles in 2014 is

US\$230 million around 55 percent of transportation revenues; among which the revenues earned by the transportation of hazardous goods and the transportation on a clearance date or days before holidays or on weekends in 2014 is US\$73 million around 32 percent of self-owned vehicles' transportation revenues. Hence, the business manager must find an optimum balance point in self-owned vehicles and outsourced vehicles to facilitate the corporate sustainable management. In other words, even if the profits generated from self-owned vehicles are poorer, their existence is still vital. Because they are able to increase the company's vehicle dispatching conveniences, as well as win high revenues from delivering hazardous goods, large orders or urgent orders. To summarize, if a company wants to run business continuity, it need to consider both financial factors and non-financial factors.

7. Limitations and Future Research Directions

This study used one container transport company, Company S, for the case study; it analyzed the effects of an outsourcing-insourcing decision integrated with an activity-based costing. Wang (2007) and Colpan (2008) pointed out that the performance effects of strategic factors are contingent on the whole environment. In addition, Isobe et al. (2008) proposed that both external and internal factors are significant for the level of improvement. Therefore, different outsourcing-insourcing decision decisions may be created by different companies in response to different enterprise cultures, external competitive environments, and product characteristics. However, the outsourcing-insourcing decision is not only important in the final answer but also in the decision process. Therefore, the decision process investigated in this study can serve as reference for container transportation companies.

The scope of this study is limited to outsourcing-insourcing decisions of the container transport firm; therefore, researchers could extend the scope of the study to other decisions, such as performance evaluation, cost strategy, or diversification, and analyze the differences between them. Furthermore, the Case Company's transportation system is only used in vehicle dispatching and has yet been

interlinked with the accounting system; as a result many data on income statement cannot be calculated and statistically analyzed by the computer, but calculated manually by the dispatcher. In the future, when transportation system has been interlinked with accounting system, researchers could use other variables, such as: relevance costs, avoidable costs, and opportunity costs to consider the effect of the transportation risks/cooperativeness on the outsourcing-insourcing decision.

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