



## ASSESSMENT OF LEAD TIME AND PAIRED SAMPLE TEST OF OUTSOURCING TRANSPORTATION BY SELECTED MANUFACTURING COMPANIES IN NIGERIA

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### ABSTRACT

*Manufacturing companies outsource transportation to ensure that their goods are delivered at the right time. Often times, due to certain fault developed by the vehicle and unforeseen circumstances on the part of the driver, enforcement agencies or condition of the road, deliveries are delayed beyond the control of the transportation companies and price of the product carried may be influenced by the cost of delivery. This study therefore examined the aggregate lead-time (a time between when order is placed for transportation to deliver and the time it actually delivered). Ten manufacturing companies were selected with multistage sampling technique with criteria that, company must be registered with Manufacturing Association of Nigeria, have more than ten fleet for haulage operations and able to carry 20 tons of goods. Chi-square analytical technique has been used to confirm that null hypothesis should be rejected as lead time is advantageous to both the logistics firm and manufacturing companies. Paired sample test between outsourcing cost and production cost is significant. With t-value greater than 15, it was concluded that manufacturing companies should keep up with the lead time and that production cost is affected by delivery cost. Using the Chi-square analysis, it can be seen that, delivery time by the outsourced companies against the expected delivery times guaranteed the use of outsourced logistics firms to carry the goods of manufacturing firms.*

**Keywords:** *Lead time, Cost, Outsourcing, transportation, manufacturing*

### 1.0 Introduction

This study has been motivated by how outsourcing of transportation cost is considered to be a factor in the price of goods distributed by haulage companies in Nigeria. While transportation companies are faced with some challenges, they are expected to deliver at the right time with right quality and quantity of goods carried from the point of origin to their destinations. According to Byne (2004) most manufacturing firms do not have required technology to monitor and operate successful logistics services and are constrained by shortage of drivers, regulations on work hours and modification of truck capacity. Meixell and Norbis, (2014) expressed that, criteria for vehicle selection and economies of scale are often not properly considered by many manufacturing companies. Most researchers had emphasized on outsourcing as the main strategy used by companies in order to concentrate on their core production function which enhances product quality (Qualye, 2006, Rushton *et al*, 2005, Power *et al.*, (2006). In general, outsourcing has a contributory effect to financial, product market share and shareholder's return on investments performance. Rushton *et al* (2005) explained that, manufacturing companies escape payment of pension, can share resources with outsourced partners, make use of expertise knowledge and technology it cannot afford and subsequently concentrate on core values by outsourcing transportation to

the third party. Managing transportation for business is not an easy task. This is more importantly so for fleet of vehicles as the owner of business cannot manage all vehicles, the route they ply, kinds of commodity carry and the manner in which the vehicle is being handled. Cost of hiring drivers, maintaining vehicles, keeping up to date documents and insurance are usually cumbersome for manufacturing companies (Wandiri, 2017). Many companies do not have the capital to set up business and then the logistic facilities at the same time. Before now, companies made use of their capacity to distribute products to depots or to customers. However, as competition increases; the challenges of late delivery, compounding inventory cost and loss of valuable customers had brought about outsourcing (Kyusya, 2015).

From the outset of distribution of products to final consumers used to be through push system. A system that does not guarantee certainty that what is demanded is quantified but pushes out the product to the end users (Rodrigue, 2024). There used to be imbalance in this kind of system as product may be distributed more than what is demanded or not enough against the demanded products by the customers. When the product is more than what is being demanded, then inventory cost will be incurred. If the products are not adequate to what is demanded, the revenue is lost. A lot of corrective approaches have been propounded to solve this problem. Among the solutions are Just-in-Time logistics, quick rapid response system and enterprise resource planning system.

Timely delivery of goods makes the goods available as at when needed. It is a good strategy for companies to ensure that, their products are available as at when needed. Majority of companies that do not provide timely delivery always end up bankrupt. Transportation is a key factor in timely delivery of goods. Since transportation is crucial, any company that is lagging behind may not compete effectively.

Outsourcing transportation by manufacturing companies will have a significant impact on the cost of product. The third-party logistics service providers are in business for profit. Hence, the manufacturing companies will realize their money from sales of the products. Therefore, it is not certain that, outsourcing transportation reduces or increases it. The essence of this research is to determine the role played by outsourcing in the performance of manufacturing firms.

Vladimir and Soppa (2020) attributed problems that call for outsourcing to the distance between production and customers. They observed that, poor condition of road necessitated outsourcing to transportation firm in South Korea. Some of the identified problem in outsourcing can be linked to failed relationship caused by unrealistic expectations, lack of trust, disregard for mutual benefits and poor communication (Boyson *et al*, 1999). Chumba *et al* (2015) noted that, not all organizations can outsource because of cost implication and capacity to meet up with certain requirements. Pressure comes to organizations due to competition and technological advancement. A company may decide to outsource because it lacks expertise, the condition or nature of what it does and inadequacy of assets (Jennings, 2002).

The importance of this study is to know the benefits derived by manufacturing companies in outsourcing the distribution of their goods. Outsourcing is considered to be a form of division of labour whereby the third party logistic service provider will specialize in the distribution of manufactured products. Outsourcing breeds specialization and specialization bring competency. In the long run competency reduces risks involved in service delivery (Gegeleso, *et al*, 2022). A number of people are employed in the transportation and logistics firms and on both sides, the manufacturing companies achieve greater output by concentrating on production and timely delivery is achieved through outsourcing of transportation. Financial investment will be appropriately positioned using outsourcing for the distribution of goods.

Production requires capital to set up as well as distribution. Hence, the capital for setting up distribution sector, hire personnel for distribution, maintenance are all reinvested in production for quality, expansion or other improvement of the company. This research serves to provide an insight to understanding the real issues in outsourcing and how to avoid unnecessary cost and non-value adding activities in a firm. Identifying and streamlining cost to those that are of importance to core activity of an organisation is essential in this study.

## 2.0 Literature Review and theoretical underpinning

Min (2015) explained Activity Based Costing (ABC) in sourcing strategy for efficient cost analysis in supply chain management. The crucial issue here is to identify and terminate avoidable cost elements. Many manufacturing and logistics service providers make use of excel software to trace costs per day, per week, per month and per year to identify the cost to eliminate. This has led to a concept even in accounting that deals with activity-based costing. This is about directly linking cost drivers to product or services with the aim of identifying which cost to retain and which to eliminate. The cost objects are identified first, and then causal relationships with activities are traced. Activity based costing is used to trace those unprofitable activities in the manufacturing and logistics service system. The purpose is to remove all non-value adding activities. Another view of this was expressed by as Transaction Cost Economics Theory (TCE) or Resource Based View (RBV) as postulated by Pratap (2014). TCE opined that, there is reduction in logistics cost when it is outsourced and thereby can enhance the performance of a firm. RBV however customers' needs are met through outsourcing (Wong and Karia, 2010). Mearig et al (1999) presented Life Cycle Cost analysis as a cost management technique used to determine discounted cost of operating, owning, disposing and maintaining assets over its useful life time. It is used in manufacturing setting and present the value of an asset as at the time of purchase. It is described as the cost of ownership, the time in which it is used as against the discounted cost to future cost.

On global sourcing transportation which requires long distance movement over the sea in particular, goods are transported from one mode of transportation to another. This process used to face bureaucracies of custom clearance, and other shipping protocols which lengthen the delivery time. Min and Galle (1991) observed that, perishable goods, time sensitive and seasonal goods can suffer or lose values if they could not meet up with the delivery time. Transportation is the most crucial factor in global sourcing factors. Furthermore, Min and Galle (1991) noted that, communication is part of the problem in global sourcing. Negotiation with foreign suppliers especially with different language used to take another time in global sourcing. Sometimes, the contractual terms may be misinterpreted or misunderstood. There are issues of hidden cost in global sourcing. Of importance for importers is to calculate the cost of shipment, customs duty and others but only to realize that cost has jumped up and there are miscalculations in global sourcing (Min and Chen, 2013). Part of the challenges is to face different government regulations in foreign countries and there may be hidden cost in transactions. Min and Chen (2013) identified some of the hidden costs in global sourcing while importing from China. These are navigation fees, anchoring fee, mooring fee, harbor fee, demurrage, insurance, loading or offloading, port charge, terminal handling charges, freight and fuel charges.

Tsai et al (2021) observed the disruption in global supply chain as a result of COVID 19 pandemic. They found out that, transportation is one of the most outsourced aspects of core services in manufacturing settings. While acknowledging that, physical items cannot be distributed without, appropriate use of transportation, COVID 19 has exposed the power of technology but yet transportation cannot be perfectly replaced by technology. The rate of failure of outsourced transportation in Taiwan necessitated a research and it was suggested that criteria should be followed before selecting supplier or outsourcee. Iboride *et al* (2021)

weigh the Pros and Cons of outsourcing among manufacturing companies in Southwestern Nigeria. They opined that, outsourcing is complex and conflicting criteria are involved in its decision making process. Also, the risks involved can be in form of loss of control by the manufacturing companies, leakage of vital information, lack of innovation accruable to executing business by themselves and inability to find perfect transport company at the right time. Considering why Nigerian Breweries Plc outsourced services of its logistics by Ayantoyinbo and Adepoju (2017) suggested that, in order to gain speed of delivery, getting raw materials and involving transportation to the core business of production will sink the money that would have been invested for more production made the Nigerian Breweries Plc opted for outsourcing. There are strategic equipment and the payment of employees which accumulate costs but can be avoided through strategic outsourcing. The risks involved in transportation and other areas like insurance, maintenance of fleet vehicles and other taxes that may be involved will be transferred to the third party. The spread of these risks is one of the benefits of outsourcing transportation to the competent logistics firm(s).

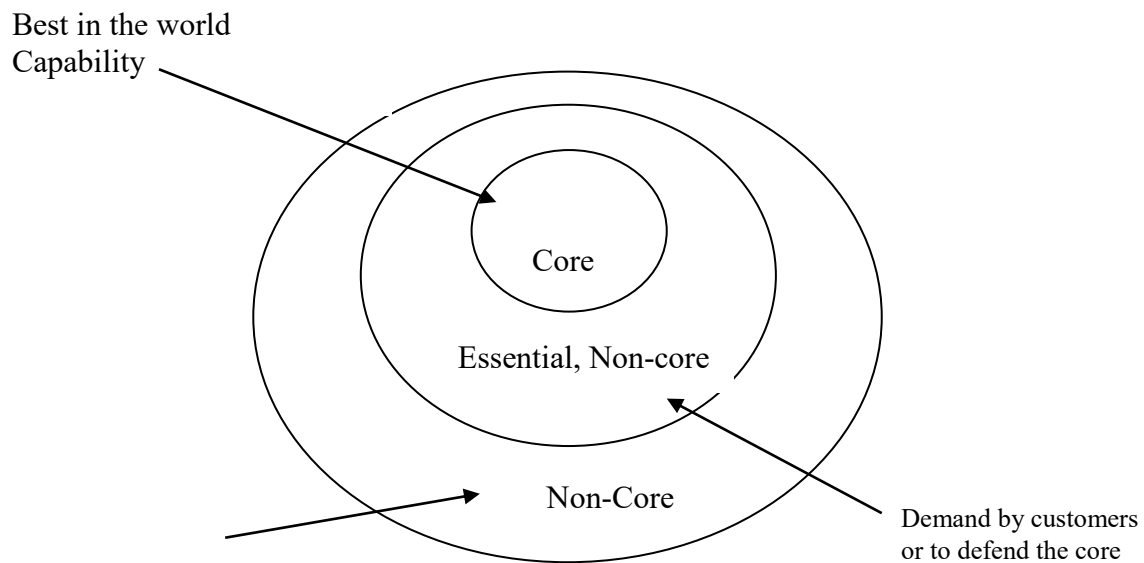
Muralitharan *et al* (2019) considered the relationship between manufacturing companies and outsourcing firm with emphasis on integrity capabilities. This they argued that, relationship of the parties can be enhanced as a result of integrity or be marred by lack of it. Furthermore, the research opined that resource utilization is more efficient by the use of outsourcing strategy which will maximize revenue, reduce production cost, and promote flexibility, quality and responsiveness. Waugh and Luke (2011) view outsourcing by manufacturing companies as a global practice to seek for growth in the dynamic competitive markets all over the world. Their research emphasized on how organizations should follow standard decision making process in form of understanding the practices, processes and issues in logistics outsourcing for effective decision making in South Africa. Mills and Opoku-Akyea (2019) provided explanations on how outsourcing widens marketing and have capability to reach places where ordinarily the manufacturing companies cannot reach. However, Resource Based Review model suggested that, marketing, technology, human resource and finance are critical areas to be monitored in strategic outsourcing. They further maintained that, core activities must be clearly understood and non-core activities should be outsourced. The paper further argued that, manufacturing can carry their products if it involves short distances or when the products are few or set up their own logistics firm. However, outsourcing should be used when it involves long distances, products are many and core activity is not transportation. The pros and cons of asset to be outsourced must be weighed before choosing either to outsource or not. Min (2015) expressed that; consideration should be giving to the analysis in the Table 1 when taking decisions on sourcing for assets.

**Table 1: Factors to consider in sourcing and outsourcing**

<b>Factor for In-house sourcing</b>	<b>Factors favoring outsourcing</b>
When it is easier to make or transport the products within the organization with lesser cost of operation	When there is no financial investment to get all facilities required for movement of goods
If it is compulsory for the organization to control distribution schedules with production to maintain flexibility in supply chain	If there is need for the organization to focus on its core production and contracts out the non-core expensive activities to improve overall supply chain management
If there is innovation developed by the organization which needs to remain secret or to maintain a technical know-how and does not face risk of technology transfer	If and when the existing personnel cannot meet up with the technology or innovation and transportation requirements
If and when there is need for an organization to manage and monitor certain product due to its value, content or sole security	If there is exclusion of an organization from carrying out services or part of it based on legal condition or patent rights
If the organization has vast experience and equipment to run or manufacture a product with understanding to gain profit embarking on such	If the demand for products is seasonal or not constantly in demand.
If there is no need for much intensive capital investment for start-up because the organization already have enough capacity to commence	If the organization does not want to deal with labour challenges, conflict and work stoppage due to strikes
If the requirements for parts and other items needed for the execution of projects are not available or used to be fluctuated.	If the volume or anticipated demand is small or the necessity for contingency plan in case of emergency is required

Source: Min (2015)

Quinn (1999) explained that, strategic outsourcing should be able to separate the core activity of an organization against the non-core activities. He explained with Figure 2.1 as presented by Gegeleso (2021).



**Figure 2.1: Core and non-core activity**

**Source:** Quinn (1999); Gegeleso (2021).

Figure 2.1 shows that a company should focus on the core activity where it has capability and have proficient manner to do it. Though, there are other activities that may be essential but are not core. The strategy here is to weigh the demand by customers for this product or service which will give an insight to either do it in-house or outsource. All non-core activities that do not bring value or add to the organization in terms of demand for product, attractiveness of service or product and profitability of same should be discarded. Allowing outsider to provide services certain segment of manufacturing or distribution operations is the focus of strategic outsourcing. The company in attempt to do this weighs the benefits in form of reducing the operating expenses. The professionals who handle the certain part are already trained and so the company that wishes to engage a firm does not need to spend on this again. The degree of efficiency and ability not to deal with what the organization does not want to get involved inn for management and control purposes.

**Cost Theory:** Cost theory is about reduction in cost as a result of economies of scale. Jayaram and Tan (2010) for instance espoused that, outsourcing transportation has reduced the cost of fixed assets, inventory and logistics. Yilmaz *et al* (2022) provided the concept behind the costs involved in outsourcing in Figure 2.2.

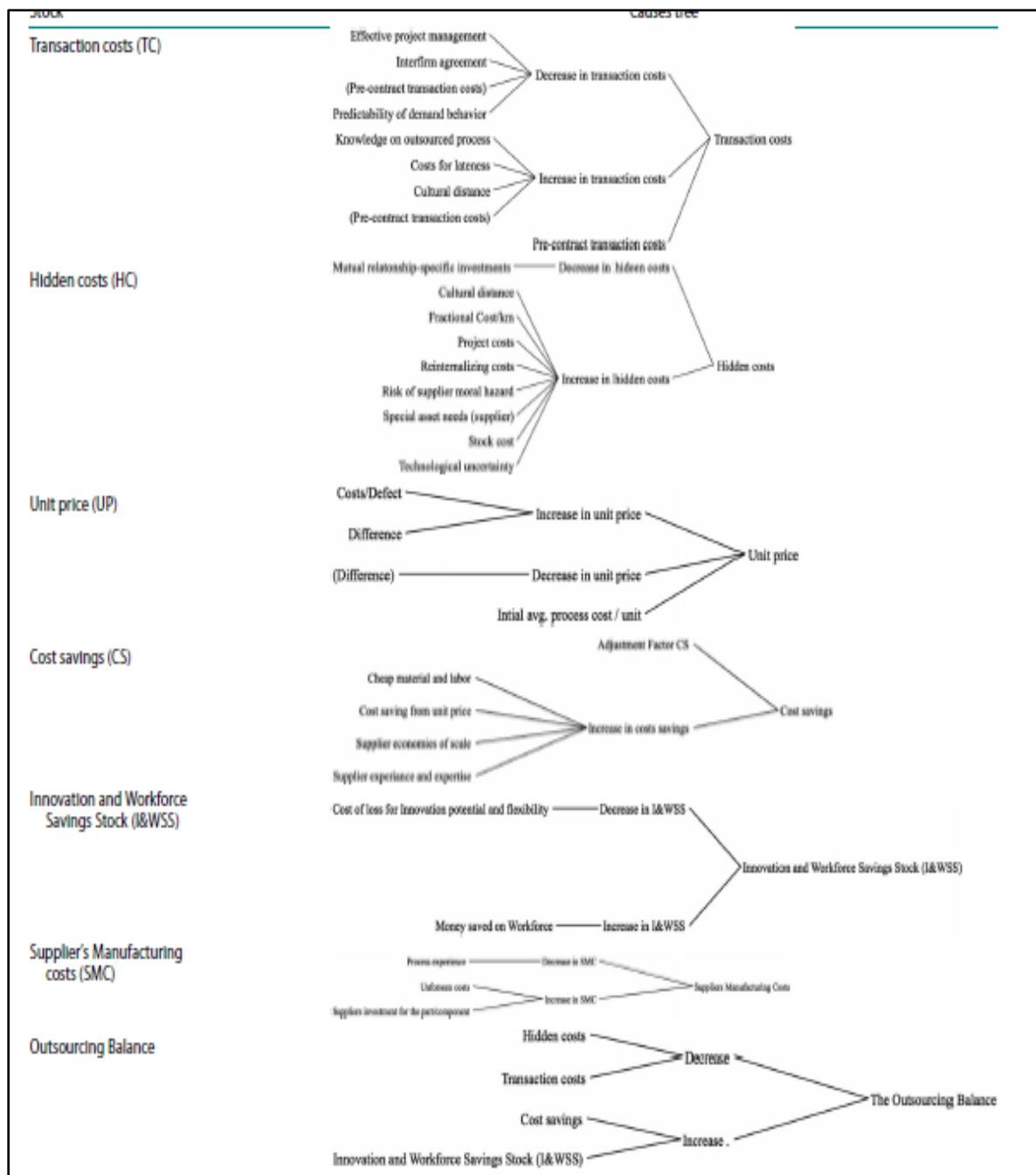


Figure 2.2: Cost involved in outsourcing and manufacturing goods

Source: Yilmaz *et al* (2022)

According to Wambua *et al* (2017), transactional cost is very important in choosing to perform a particular activity. The cost analysis for transaction explains that, transaction must be divided into two: production cost and coordination costs. This is very important in sourcing strategy. The reason is because; sourcing for asset that will increase expenditure without any justifiable fact should not be used. However, it is not in all cases that, sourcing will be out rightly beneficial especially when exigent situation is involved. One of such cost analysis is transactional cost. Transactional cost is related to accounting cost where each transaction is targeted to a cost. An example of cost is measuring cost for direct labour hour, direct labour cost and machine hours. This method can distort the true cost of making products or rendering

service, because it is hard to associate the specific volume of direct labor or direct material with the final output; therefore, a single output of indirect costs assigned for the entire production unit (for example, production or another department) can be either over estimated or under charged. In traditional costing, idle machines are allocated cost to product which product did not consume during idle time. Manufacturing firms must consider these costs to know what to outsource per time. In the explanation of the Transactional Cost Analysis by Wambua *et al* (2017) where they discussed the construct of transactional cost to consist of frequency of the transaction, uncertainty in the transaction, the bounded rationality of the transaction, asset specificity of the transaction and opportunistic behavior. Cost decisions come with opportunity cost. In logistics, either to outsource or carry goods with in-house vehicles capital investment trade-offs with comparing other service provider's options. In this case, often times; the lowest cost option will be selected which is outsourcing (Selviaridis & Spring, 2007). Apart from cost, there are other factors that are considered in logistics decisions like customers' satisfaction which can be based on relationship or capability. Also, apart from procuring assets, labour and equipment maintenance costs are taken care of with the aid of outsourcing. While looking at various cost involved in logistics, there are certain cost that are hidden and can only discovered during the operations.

### 3.0 Methodology

Nigeria is one of the West African countries with forecasted population of over 200 million. The country has 36 states and Federal Capital Territory in Abuja. Gegeleso (2021) explained that, the country has 774 Local Government Area and also six geopolitical zones. The geopolitical zones are South West, South South, South East, North West, North East and North Central (Constitution Amendment, 2012). The population for this study composed of the registered companies from the Manufacturer Association of Nigeria. There about 2987 manufacturing companies in Nigeria (NSE, 2019). Ten manufacturing companies were selected with multistage sampling technique with criteria that, company must be registered with Manufacturing Association of Nigeria, have more than ten fleet for haulage operations and able to carry 20 tons of goods. Respondents are the logistics managers of the selected manufacturing companies. Reliability test of data was conducted and interval measurement scale was used on the questionnaire distributed. The list of observed and expected number of days to cover the distance for the transportation company was traced from the records of the delivery reports of the manufacturing companies. The records show the approximated number of days expected for delivery by the selected companies in aggregate of ten years and the actual delivery record.

### 4.0 Results and Discussion

Physical distribution of goods is crucial to the availability of manufactured products that are undoubtedly not meant to be situated in the manufacturing environment but far distance because of scatted consumers all over the world. Companies have options of either to use its own vehicle for the haulage of goods or use third party logistics service providers. Table 4.1 provided the aggregated data for the expected and actual lead time for the selected companies.

**Table 4.1: Lead Time Data**

Logistic com	expected	Observed
AMZAN	3.00	2.00
ZEDAN	2.00	1.00
TOP LOGISTIC	5.00	4.00
AOP	4.00	4.00
HAUL LINE	3.00	2.00
JET	5.00	3.00



RAMBAM	2.00	2.00
RAPID	1.00	1.00
MOYO	1.00	1.00
JAZI	2.00	1.00
EXPO	2.00	1.00
TANLO Ltd	3.00	2.00

Source: Logistics companies' fleet movement records (2022)

This segment presents the result and discussion of the findings. All data collected were analyzed. The first objective is to evaluate the lead time delivery service with outsourcing of transportation. This is done by assessing the time given by the manufacturing companies to deliver goods to the named third party logistics firms and the actual or observed time they deliver the goods (lead time). Table presented the data for the lead time by the various third-party logistics firms. The data collection asked for the longest distance in the list of delivery of the selected manufacturing companies with the aim of aggregating monthly data of recorded time the transportation companies delivered and the time allocated for them to deliver by the companies.

The data for lead time in the Table 4.1 has been analyzed with the use of Chi-square with the result shown in the Table 4.2. The result shows that, null hypothesis should be rejected and alternate hypothesis should be accepted because  $p < 0.005$  at 0.028 is significant. This shows that, logistics companies will be patronized continually by the manufacturing setting because of the fact that the lead time is advantageous to them. This is in line with the findings of Budler et al (2021) who observed that, outsourcing increases companies' performance in manufacturing sector.

**Table 4.2: Chi-Square analysis**

	Chi-Square Tests		
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.950 <sup>a</sup>	12	.028
Likelihood Ratio	22.409	12	.033
Linear-by-Linear Association	8.730	1	.003
N of Valid Cases	12		

a. 20 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

Source: Output from SPSS (2022)

The testing of the hypothesis was carried with the help of Chi-square analysis shown in Table 4.2. Since the sig. value is  $< 0.05$  this means that the null hypothesis should be rejected and alternate hypothesis be accepted. The analysis revealed that, transportation companies are still doing fine to meet up with the timely delivery for their respective organizations.

In other to further test if outsourcing transportation have influence on the price of manufactured product, a paired sampled T-test was conducted. This is to achieve the second objective of the study. Table 4.3 presented the result of the analysis. The t- value shows high level of significance with  $p < 0.05$  at  $t = 15.572$ . Therefore, the data shows that null hypothesis will be rejected. The manufactured products' price used to change arising from the use of external transportation for the distribution of goods across the selected companies.

Table 4.3: Paired sampled T-test between Product price and outsourcing cost

**Paired Samples Test**

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 price - outsourcing	164.66667	36.63166	10.57465	141.39202	187.94132	15.572	11	.000

Source: Output from SPSS (2022)

This research work has been able to prove that, outsourcing is still significantly affecting the performance of manufacturing companies for good. Recognizing the effect of outsourcing on the performance of transportation, the survey and research conducted by Budler et al (2021) noted that warehouse is another area where companies are trying to focus on with a view to achieving similar result. Generally, the third-party logistics should endeavor to keep up with the delivery time so as to guarantee the continuous patronage by the manufacturing firms.

**5.0 Conclusion and recommendations**

There is no doubt about the fact that transportation efficiency will improve the timely delivery of goods. In turn, timely delivery of requested order can lead to customer’s satisfaction. The result here shows that manufacturing companies will continue to patronize the logistics and distribution companies. The lead time is the time in between when order is made and that order is delivered. Using the Chi-square analysis, it can be seen that,delivery time by the outsourced companies against the expected delivery times guarrated the use of outsourcing firms to carry the goods of manufacturing firms. Though, the level of satisfaction is not shown in the Chi-square analysis in order to explain the areas or ascertain level of satisfaction of delivery, this can be an area to explore in future research. Nonetheless, it is obvious that, transportation outsourcing cost is actually affecting the price of commodity distributed from the T-test. Strategic outsourcing requires that both the manufacturing companies and logistics firms know when to enter into a favourable agreement through the provisions of criteria that suits in-sourcing or outsourcing.

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