

Cost Analysis for Different Hospital Procurement Models

Sin-Ying Ciou¹, Yu-Ru Huang¹, Nai-Chuan Fang², Chuang-Chun Chiou¹ (1. Department of Industrial Engineering and Enterprise Information, Tunghai University, Taiwan 2. Taichung Veterans General Hospital, Taiwan)

Abstract: Different procurement models will affect the total cost and service level. Centralized procurement is an integrated model for replenishing the first tier and second tier demand units in a hospital. It can take the advantage of obtaining a higher discount from the supplier by ordering a larger volume. The centralized model is commonly used in a hospital medical supply system. Especially, for the large scale medical center, it can consolidate the demands of different demand units and branches. However, it will affect the efficiency and lower the service level. The purpose of this study is to establish a cost analysis model to assist managers in making procurement decisions. We proposed a different model (To-Be model) and conducted a comparison with the current model (As-Is). Cost drivers along the procurement process are analyzed. The analysis models are applied to evaluate the impacts of different models by using empirical data from a medical center located in central Taiwan. Finally, a sensitivity analysis was performed to know the effect of the difference in parameter values on the total cost. This evaluation mechanism can also show the distribution of costs in procurement operations, make the relevant costs visible, and help managers can develop further improvement plans.

Key words: procurement model; cost analysis; decentralized model; price discount

JEL code: I1

1. Introduction

In an aging society, health care expenditures are rising. The medical systems usually have a high inventory level in order to maintain service standards. The procurement logistics as a part of the hospital expenditure, and the procurement logistics have the potential reducing the cost without affecting the service level. As a country based on manufacturing, Taiwan has a fairly mature management method for inventory control, but it cannot be directly applied to the medical system. For example, the concept of Toyota production system is applied to the replenishment processes to establish long-term cooperation with suppliers to achieve the JIT replenishment and reduce inventory costs. The hospitals in Taiwan are divided into public and private. Public hospitals are subject to government regulations and cannot establish long-term cooperative relationships with a single supplier. In addition, there are GPOs (Group Purchasing Organization) in the United States, the organization is based on the centralized procurement of the surrounding hospitals, and negotiates with upstream suppliers to reduce procurement costs by centralize the material which the surrounding hospitals need to reduce procurement costs.

Medical institutions and branches with the same system have advantages in the operational processes that can

Chuang-Chun Chiou, Ph.D. in Industrial Engineering, Professor, Department of Industrial Engineering and Enterprise Information, Tunghai University; research area: supply chain management. E-mail: cjchiou@thu.edu.tw.

be combined, but in a central medical institution in Taiwan and three branches, they have been separate and independent for many years in procurement operations. The method of public bidding selects the supplier of medical materials, and then contracts with it. The branch contacts the supplier by the contract when they purchase of the same material, the inventory is stored in each hospital. This operation model does not use its own advantages to conduct procurement operations with suppliers.

This study mainly focuses on the premise of not affecting the service level, centralized procurement centralized inventories (To-Be) and centralized contracted decentralized inventory (As-Is) whether the medical institution and branch can effectively reduce the total procurement cost. The To-Be operating modes can reduce the procurement operations of branches, the third-party logistics is responsible for the transportation and the picking, to improve the efficiency of the process optimization, and establish an evaluation mechanism to assist the managers to make decision of procurement.

2. Literature Review

2.1 Cost Analysis and Its Importance

The cost includes the total procurement cost of all medical institutions. In order to obtain the cost advantage and enhance the competitiveness, through modeling, the cost analysis shows the results in a quantitative way; then the results of the analysis show whether the cost is reduced. Almeida and Cunha (2017) refers to the application of the costing method for operations (ABC), a brief description of ABC is a measure of the cost and performance of operations and cost objects. It has three basic premises: product demand operation, operation resource consumption and resource cost. Implementing this method in the enterprise can get the weight of each operation in the final cost structure, which helps to understand the company's resource allocation.

In order to improve competitiveness, Bokor (2012) mentioned the application of this method concept to LSP, the company should understand its cost, profit and performance. The study represents LSP cost in a hierarchical way, analysis cost the structure understands the post-causal modeling and measures the performance of each cost object by using the estimated data input to develop and test the sample cost calculation plan. Hongshu (2013) mentioned that in order to obtain cost advantages, enterprises propose two main methods, one is to control cost drivers and the other is to rebuild value chains. In many enterprises, procurement costs account for a large part of the total product cost. Enterprises can control cost drivers through procurement strategies to obtain cost advantages. On the other hand, through the reorganization of procurement strategies to implement continuous optimization of procurement management of resource elements, shortening Purchasing cycle to reduce inventory holding costs. In order to model and evaluate whether there is a reduction in procurement costs, it is mentioned in Dewi et al. (2015) that in order to minimize the total procurement cost, it is necessary to choose the appropriate cooperation strategy to manage the PC (Purchasing consortium). In the procurement activity, the study divides the procurement activities into seven cost combinations, and models the minimization of the total procurement cost as an objective function, and then brings in the data examples to evaluate the performance and identify the key factors through the sensitivity analysis. Serrou and Abouabdellah (2016) refers to the use of CQS cost, quality and safety concepts for performance measurement, mainly divided into two stages of process analysis and performance evaluation, first compare the procurement process of the two structures, then performance evaluation Modeling and bringing in real hospital data, it is concluded that centralized procurement can effectively reduce the total procurement cost and optimize the controllability and traceability of information.

2.2 The Comparison of Different Models

Rossetti et al. (2008) mentions that in the traditional model, suppliers ship their products to distributors. Through the dealer's warehouse, the products are packaged in pallets and shipped to the warehouses of the hospitals, which then receive the pallets, break them down into smaller quantities, and store the products until the hospital needs them. Sometimes the ordering action is also made directly with the supplier. In Mercy's new model, the centralized warehouse system replaced the sub-distributors, eliminating the need for hospital warehouses, and the suppliers shipped directly to a central warehouse called the Central Service Center (CSC). CSC breaks down the goods into smaller units and repackages them for hospital use and ships them directly to the hospital, called the Strategic Service Unit (SSU). The Mercy network consists of approximately ten hospitals in four states. If the hospital is not close enough to the CSC, the material is docked in the middle. From the above, we can see the difference between the traditional mode and the new CSC.

2.3 Logistics Optimization and Logistics Outsourcing and Its Performance Impact

Logistics optimization refers to the process of determining the development goals of the logistics system, and designing the strategy and action to achieve the goal. It optimizes the combination of factors related to the logistics system according to certain methods, degrees and principles, so as to better realize the logistics system. The goal of development. In Volland et al. (2017), the annual expenditure on health care increased by 4%, while logistics is the second largest cost of hospitals. Effective logistics management can eliminate the logistics-related costs of most hospitals. Logistics optimization is quite the most significant is that he can reduce costs without affecting the quality of patient care. In order to understand whether the outsourcing is feasible and the performance it brings (El Mokrini et al., 2016), it is mentioned that medical institutions and centrally centralized procurement of centralized inventory will increase the cost of allocation and transportation, and they have developed a process of helping decision makers determine whether logistics outsourcing is feasible for the organization is mainly three steps, namely situation setting, design and selection. Each step contains sub-process and decision process description. As for the performance of logistics outsourcing, it is mentioned in Arif Eland Jawab (2018) that it elaborates the impact of logistics outsourcing on the performance of logistics services such as shortening cycle time, providing service efficiency and reducing logistics costs.

3. Case Study

Practical application the historical data of a medical institution in the central part of Taiwan and their branches from 2017/01/01 to 2017/12/31, and the result is shown in Table 1. Add the four hospitals procurement cost which were separate calculation then we would get the total procurement cost was NT\$1,617,512,554. Table 1 reveals that the cost of medical materials is the highest cost. If centralizes the demand of material which the three branches need, higher discounts are obtained in large quantities which can effectively reduce the total procurement cost.

Then, the historical data of the medical institutions and the three branches are combined. The order lead time of medical materials rely on the medical institution. The order lead time of the particular medical material used by the other branches are the average of other branches, and the logistics outsourcing costs are offered by the third-party logistics. Table 2 shows the results of To Be and compares them with AS IS.

Cost Analysis for Different Hospital Procurement Models

	Medical Institution As Is	Branch 1 As Is	Branch 2 As Is	Branch 3 As Is	As Is Total cost
(1) Medical Material Cost	1,331,375,133	161,675,321	70,815,648	6,930,227	1,570,796,331
(2) Bidding Cost	2,904,938	0	0	0	2,904,938
(3) Ordering Cost	2,211,404	970,174	321,772	103,143	3,606,494
(4) Acceptance Cost	1,326,842	600,108	199,034	63,800	2,189,785
(5) Inventory Carrying Cost	32,219,278	3,912,543	1,713,739	169,447	38,015,007
Total	1,370,037,596	167,158,146	73,050,194	7,266,617	1,617,512,554

 Table 2
 Cost Comparison Between the Medical Institutions and Branches (As Is)

Table 3 Cost Comparison Between To Be and As Is

-					
	TO BE	AS IS			
(1) Medical Material Cost	1,578,981,692	1,570,796,331			
(2) Bidding Cost	4,037,360	2,904,938			
(3) Ordering Cost	4,235,007	3,606,494			
(4) Acceptance Cost	2,541,004	2,189,785			
(5) Inventory Carrying Cost	38,211,357	38,015,007			
(6) Logistics Outsourcing Cost	255,552	/			
Total	1,628,261,972	1,617,512,554			

Table 2 shows that To Be is higher than As Is without adding a discount rate at all. In terms of the cost of medical materials, since the price may cause price fluctuations due to the increase in National Health Insurance, this study calculates the average price for the whole year. The price of the branches and the medical institution will also cause the difference in unit price due to the difference in the order quantity. To calculate the total purchase cost of To Be rely on the unit price of a medical institution.

The three costs of bidding cost, ordering cost and acceptance cost was all be responsible for the medical institution. The labor cost in the process was also calculated according to the salary of the medical institution.

Sensitivity Analysis	Total cost		
As Is	1,617,512,554		
To Be	1,628,261,972		
Discount 3.7%	1,568,425,829		
Discount5%	1,547,402,319		
Discount10%	1,466,542,667		
Discount20%	1,304,823,362		

 Table 4
 Sensitivity Analysis of the Discount Rate

Finally, the sensitivity analysis is carried out by changing the discount rate, and the remaining parameters remain unchanged. The goal was to see the impact of the discount rate change on the results, and the medical material cost was added to the historical data with an average discount rate of 3.7% and the rest of 5%, 10% and 20% compared with As Is, the results shown in Table 3. We could be found that the discount rate of 3.7% had effectively reduced the total cost, and compared with AS IS a total reduction of NT\$49,086,725.

4. Conclusion

From the results of case study, it showed that changes in discount rates have a direct impact on the efficiency of centralized procurement. In the To Be model, a centralized model, the demand of material which the three branches need, higher discounts are obtained in large order quantities. The sensitivity analysis showed that at the discount rate of 3.7% which calculated by the historical data discount rate with an average. It can reduce the total cost effectively by the amount of NT\$49,867,625.

In this study, only the benefit of the cost saving is illustrated. However, the implementation of the To-Be program can reduce the inventory space of branches and greatly reduce the time and labor costs associated with the procurement of branches. The branch is not expressly than the medical institution in terms of division of labor. By centralizing procurement, the procurement operation can be made up of medical institutions, and the improvement of the operation mode can promote the professional division of labor to improve efficiency in procurement operations.

Some medical materials are only used in branches. Not all hospitals have this special medical material needs. This study can also assess the future when new medical materials are added and which program is applicable in procurement modes to achieve the minimum procurement cost. In addition, this evaluation mechanism can not only help managers determine the future procurement model, but also help to understand the cost of the current model in each process and clearly understand the cost distribution, and then focus on improvement.

Acknowledgements

This Research is partially supported by Ministry of Science and Technology (MOST) of Taiwan under grant number 109-2922-1-029-022.

References

- Almeida A. and Cunha J. (2017). "The implementation of an Activity-Based Costing (ABC)system in a manufacturing company", *Proceedia Manufacturing*, Vol. 13, pp. 932-939.
- Arif J. and Jawab F. (April 2018). "Outsourcing of logistics' activities: Impact analysis on logistics service performance", in: 2018 International Colloquium on Logistics and Supply Chain Management (LOGISTIQUA) (pp. 88-92). IEEE.
- Bokor Z. (2012). "Cost calculation model for logistics service providers", *Promet-Traffic & amp; Transportation*, Vol. 24, No. 6, pp. 515-524.
- Dewi S., Baihaqi, I. and Widodo E. (2015). "Modeling pooled purchasing strategy in purchasing consortium to optimize total purchasing cost", *Procedia Manufacturing*, Vol. 4, pp. 478-486.
- El Mokrini A., Benabbou L., and Abdelaziz B. (2016). "A decision aid process for strategic insourcing/outsourcing in a supply chain", in: 2016 3rd International Conference on Logistics Operations Management (GOL), IEEE, pp. 1-6
- Hongshu Z. (June 2013). "Dynamic model based on the theory of purchasing decisions of the full life cycle costs", in: 2013 International Conference on Computational and Information Sciences, IEEE, pp. 332-335.
- Rossetti M. D., Manuel D., Douglas M., Prabhu S., Bhonsle A., Sharp S. and Liu Y. (2008). "Inventory management issues in health care supply chains", University of Arkansas, pp. 1-33.
- Serrou D. and Abouabdellah A. (2016). "Logistics in the hospital: Methodology for measuring performance", ARPN Journal of Engineering and Applied Sciences, Vol. 11, No. 5, pp. 2950-2956.
- Volland J., Fügener A., Schoenfelder J. and Brunner J. (2017). "Material logistics in hospitals: A literature review", Omega, Vol. 69, pp. 82-101.