

Analysis of liquids and chemicals costs in a sample port

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ABSTRACT: In recent years, the application of Activity-Based Costing in Port industry has been deeply researched in theory and practice, but researchers only concentrate on the bulk and general cargo's ABC in loading and unloading operations and there is little about the liquids and chemicals'. Based on the liquids and chemicals' handling process and the particularity of their cost accounting, the paper establishes quality and safety activity center, steam heating, electric trace heating activity center, temperature maintenance activity center and so on. At the same time, the paper focuses on their cost drivers and their measuring method in order to improve the accuracy of costing in loading and unloading operations.

Keywords: Sample port; Liquids and chemicals; Activity center; Cost drivers equivalent

INTRODUCTION

Activity-Based Costing which is widely used with a wealth of practical and applied experiences in foreign countries is an advanced cost measuring method. Since ABC was introduced into Iran, it has been attracted the attention of academics, gradually accepted and applied by some of our businesses.

There is no exception to Port industry's enterprises. Domestic scholars mainly introduce the results of research abroad as to ABC. They also do research actively on the application of ABC according to actual situation in Iran.

Professor Wang Pingxin has piloted the use of activity management in the advanced manufacturing enterprises since 1998, and achieved great success (Junming and Pingxin, 2004). Li, Qi and other professors has discussed about the application of ABC in Port industry's enterprises (Li and Qi, 2005). Yang Hui has

studied the strategic cost management in Port industry (Hui, 2006).

Currently, the applied research on ABC in Port industry was mainly about bulk and general cargo. Because of the special nature of the liquids and chemicals' loading and unloading operations, the special study on liquids and chemicals' ABC in loading and unloading operations has not been conducted.

This article aims to design the model of liquids and chemicals' ABC in loading and unloading operations based on the classify cargo and operation activity. On the one hand, with the development of scale economy and the increase of imports, port throughputs of liquids and chemicals have increased; on the other hand, in order to ensure the accuracy of cost information in Port industry's enterprises, make all the decisions more scientifically, strengthen the cost's management and control, and optimize its task chain, we can see that the study on liquids and chemicals' ABC in loading and unloading

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operations has important practical significance. At the same time, it is good for making a useful exploration of liquids and chemicals' ABC in loading and unloading operations which is suitable for Port industry.

MATERIALS AND METHODS

The Costing of Liquids and Chemicals' Loading and Unloading in a sample Port

- The specificity of the costing of liquids and chemicals' loading and unloading in a sample port

The main types of liquids and chemicals in Port industry are crude oil, processed oil, diesel, chemicals. In the process of loading and unloading operations comparing to other types of cargos, liquids and chemicals have their own characteristics. Take sea and railway transportation and ship-loading activities of

processed oil and chemicals in a company for example, oil and chemicals will be transported by train to the branch as shown in (Fig. 1). First, we need to unload the cargo from the train through the trestle, during this process, not only does it involve the care, maintenance, reversing the process, switching the valves and other manual activities, but also it needs electricity consumed by pump oil, the materials of bridge maintenance, removing and jointing bump ,pushing the train and other miscellaneous operations .Second, the oil and chemicals are imported to the tank through the pipeline, during this process, the activities involved with the pipelines are labor fees of line inspection and maintenance, electric heating, the materials of maintenance, nitrogen used by pipeline cleaning, electricity and so on; the activities involved with

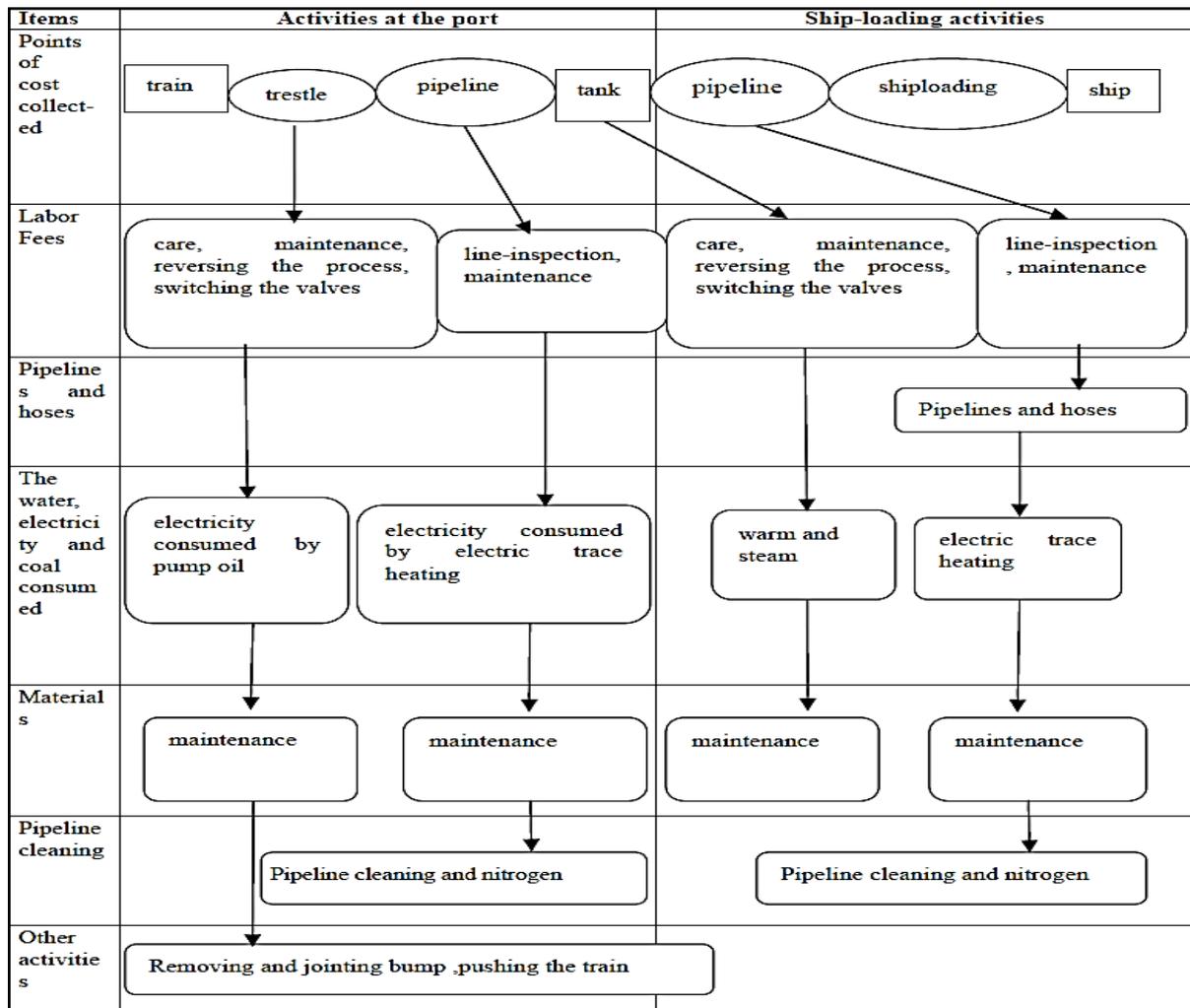


Fig. 1: Fuel's Railway Transportation and Ship-loading Processes in a sample Port

the tanks are labor fees of care, maintenance and reversing the process, coal, water and electricity consumed by heating, steaming and bump house, various materials of maintenance. Finally, the oil and chemicals are shipped by pipelines, the shipment also involves labor fees of care, maintenance, reversing the process, switching the valves and the consumption of oil pipelines and hoses.

From the liquids and chemicals' loading and unloading operation processes, we can see that the costing of it has distinctive characteristics:

First, the security costs hold a large proportion. Because many kinds of chemicals are flammable, explosive, leaking, toxic, polluting the environment, etc., the fuel leak accident in Dalian Harbor is an example which is still very alarming.

Second, the indirect costs hold a large proportion, and with the conventional method it is difficult to assign. In the process of liquids and chemicals' loading and unloading activities, the amount of direct costs, such as the labor fees of switching the valves, the consumption of hose, is small. Well, the significant cost lies in the pipeline maintenance, the performance of warming, heating, generating nitrogen and other related equipments or facilities' operation and maintenance. Different types of fluids and chemicals are loaded or unloaded through the same pipeline, using the same equipments and facilities, but different types of fluids and chemicals consumed different resources in handling operations, because they need different temperatures in the temperature maintenance and heating. Thus, accurate allocation of indirect costs is very difficult.

Third, the cost accounting is complex. Before the liquids and chemicals are loaded or unloaded at the port, the pipelines are required to clean or preheat, they are still needed to clean through the ball after all the activities. In addition, the resources consumed by different kinds of liquids and chemicals in different seasons are also different. As to different kinds of them, they consume different resources because of different requirements of temperature maintenance and heating. Even if load or unload the same kind of liquids or chemicals, the consumption of

resources in autumn and winter is more than in summer.

- *Costing process of liquids and chemicals' loading and unloading in port industry*

Based on the theory of ABC, the costing process of liquids and chemicals' loading and unloading in port industry follows as below: determine the costing object (classify cargo and operation activity), confirm the consumption of resources, divide costs into direct costs and indirect costs, accumulate direct costs, set activity center, identify cost drivers and allocate indirect costs. Among them, setting the activity center and identifying cost drivers are the key factors of the costing of liquids and chemical 'loading and unloading which will directly influence the precision, so this paper focuses on these in the research.

1- Set activity center. According to the handling processes of liquids and chemicals at the port, characteristics of the cost, and the management, the activity centers of the liquids and chemicals' handling can be divided into eight activity centers (Bennett, 1996) as is shown in (Table 1).

2- Determine the driver of resources and accumulate costs of activity centers according to it. We should pay attention to that some direct costs also need to be collected into activity center in order to meet the requirements of management. For example, the quality and safety activity center includes some certain direct costs.

3- Identify the cost drivers and distribute costs collected according to cost drivers to every cargo and every operation in turn (Babed and Balachandran, 1993). The cost of an activity center is calculated as follows:

Costs of activities accumulated to certain cargo
= Cost drivers consumed by this cargo × the distribution ratio of the activity center.

The distribution ratio of the activity center =
Total expenses consumed in the activity center /
Total cost drivers consumed by every cargo

Costs of activities accumulated to certain cargo and certain operation = Cost drivers consumed by this cargo and operation × The distribution ratio of the activities' costs of this cargo and operation
The distribution ratio of the activities'

costs of this cargo and operation = Costs of activities accumulated to certain cargo/ Total cost drivers consumed by this cargo's every operation

4- Calculate the total costs and unit cost of a certain kind of cargo's certain operation The total costs of a certain kind of cargo's certain operation = Direct costs of this kind of cargo's certain operation + The total costs assigned to this kind of cargo's certain operation from activity centers

The unit cost of a certain kind of cargo's certain operation = The total costs of this kind of cargo's certain operation /The activities of this kind of cargo's certain operation

5- Calculate the total costs and unit cost of a certain kind of cargo's whole operation The total costs consumed in the whole operation of a certain kind of cargo = The total costs consumed in the whole operation of loading and unloading of this kind of cargo The unit cost consumed in the whole operation of a certain kind of cargo =The total unit costs consumed in the whole operation of loading and unloading of this kind of cargo.

RESULTS AND DISCUSSION

1- The calculation of the cost driver units of the quality and safety activity Through investigation, we find out that the resources and energies caused by safety and quality activity are distributed based on the risk of every cargo and every operation, which is realized by the general managers, deputy general managers in charge of safety and quality and other people in the business department related to management of safety and quality. Therefore, the cost's distribution

of the quality and safety activity center can be in accordance with this causal chain- "high risk – high concern – more resources allocated", the risk in every cargo and every operation is the quality and safety activity center's cost driver. In our dealings, we collect many people's awareness of the risk through questionnaire, these people can be the general managers, deputy general managers in charge of safety and quality and other people in the business department related to management of safety and quality. Then analytic hierarchy process (AHP) is applied in processing data. At last, it is time to calculate the risk ratio.

2- The calculation of the cost driver units of the steam heating and electric trace heating activity Let's look at the calculation of the steam heating activity's cost driver units. In order to simplify the calculation of the cost, the company will usually divide cargos into several types, such as category one (crude oil), category two (processed oil), category three (chemicals), and so on. Obviously, different temperatures of different oils have to be met, there can be different requirements for heating, so the steam heating activities' cost each category of oil consumed is different from each other. Then it is true that batch number of tanks equivalent is determined as the steam heating activity center's cost driver.

Batch number of tanks equivalent can be calculated as below:

Firstly, select a type of oil in category one as the standard, when load and unload it one time, the batch number of tanks equivalent is to be one. Then compute the heat the standard needs when reaching the required temperature and the heating.

Table 1: Activity Centers and Cost Drivers

The serial number	Name	Cost drivers
1	Activity pools of production capacity depreciation	Objective throughput
2	Administration center	The number of customers maintaining
3	Quality and safety activity center	Risk ratio
4	Nitrogen activity center	Batch number of activities
5	Terminal activity center	The activities of vessels at a time
6	Steam heating activity center	Batch number of tanks equivalent
7	Electronic trace heating activity center	Operational ton equivalent (the total tons in and out of the tank)

Secondly, calculate batch number of tanks equivalent of category two as below. Select a type of oil in category two, compute the heat it needs when reaching the required temperature and the heating.

Equivalent coefficient = the heat of warming and tracing of category two / the heat of warming and tracing of category one. Batch number of tanks equivalent of category two = Batch number of tanks × Equivalent coefficient.

Thirdly, batch number of tanks equivalent of category three can be calculated. The method is as same as above.

As to the cost driver units of the electric trace heating activity,

Operational ton equivalent of certain cargo (the total tons in and out of the tank) = Operational ton of this cargo × equivalent coefficient of this cargo

3- The calculation of the cost driver units of the temperature maintenance activity The heat in the summer different oils need when storing in the tank and maintaining the temperature, is quite different from that in winter. So storage ton equivalent per day is determined as the cost driver units of the temperature maintenance activity. It can be calculated as below.

Firstly, select one type of oil as the standard. When it stores in the tank one day, it can be one storage ton equivalent per day. Then compute the heat this type of oil needs when reaching the required temperature and the heating.

Secondly, calculate the storage ton equivalent per day of other types of oil as below. Compute the heat the cargo needs when reaching the required temperature. Equivalent coefficient = The heat of maintenance of this type of cargo / The heat of maintenance of the standard. The storage ton equivalent per day of this type of oil = The storage ton per day of this type of oil × Equivalent coefficient.

CONCLUSION

The application of ABC when calculating the cost of liquids and chemicals' loading and Unloading in one Port industry's enterprise shows that:

- 1- It is applying the ABC when calculating the cost of liquids and chemicals' loading and unloading in Port industry's enterprises that improves the accuracy of cost accounting and provides diversified cost information to all the relevant people. Setting the activity centers rationally, such as the nitrogen activity center, steam heating activity center, electric trace heating activity center and so on, and putting forward a variety of cost drivers adapt to the process of loading and unloading the liquids, chemicals and the features of cost accounting. Thus it definitely improves the accuracy of cost accounting. Meanwhile, calculating the quality and safety activity's costs and production capacity depreciation costs in terms of a wealth of cost information is good for safety and quality management, production management in Port industry's enterprises.
- 2- By means of cost driver's equivalent, we improve the accuracy of the indirect cost allocation related to liquids and chemicals' handling equipments and facilities. It's different from others' cargo-handling technology, loading and unloading of liquids and chemicals involve pipelines and storage tanks, Different oil requires different technologies of warming, trace heating and charging nitrogen. It is distributing these related costs by applying the cost driver's equivalent that improves the accuracy of cost information.
- 3- To determine the cost drivers of the quality and safety activity center, we adopt AHP creatively to improve the objectivity and accuracy of cost drivers. Based on the causal chain-"high risk - high concern - more resources allocated", we collect managers and site operation personnel's awareness and data of the risk in the process of loading and unloading through questionnaire. What is more important is that analytic hierarchy process (AHP) in data processing makes cost drivers more objective and accurate.

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