Muhasebe ve Finansman Dergisi – Ağustos 2019 Özel Sayı 301-312

ISSN: 2146-3042
DOI: 10.25095/mufad.607144

Costing Logistics Activities of Logistics Service Companies: A Case Study and a Model Proposal*

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ABSTRACT

Logistics has become an important factor affecting the competitiveness of enterprises. The fact that logistics involves purchasing, supplying, production and distribution processes leads to many different cost elements. This draws attention to the need for managers to make proper decisions with reliable data so that logistics operations can be carried out more efficiently in terms of performance and cost. This study aims to reveal how logistics costs are integrated into production costs in current applications. Also this study focuses on improving costing methods for logistics companies –port companies in particular-. In order to achieve this goal, a case study including the logistics costs of a port company was conducted. In addition to the case study, a new cost distribution model proposed. The results of the study indicate that the integration of the costs related to the logistics activities to the production costs will provide many competitive advantages.

Anahtar Kelimeler: *Logistics costs, cost accounting, cost management, cost distribution model*

JEL Classification*: D24, M40, M49.*

Lojistik Hizmet Şirketlerinde Lojistik Faaliyetlerin Maliyetlendirilmesi: Bir Vaka Analizi ve Model Önerisi

ÖZET

Lojistik, işletmelerin rekabetçiliğini etkileyen önemli bir faktör haline gelmiştir. Lojistiğin, satın alma, tedarik, üretim ve dağıtım süreçlerini içermesi birçok farklı maliyet unsuruna yol açmaktadır. Bu, lojistik işlemlerinin performans ve maliyet açısından daha verimli şekilde yürütülebilmesi için yöneticilerin güvenilir verilerle uygun kararlar alma ihtiyacını gündeme getirmektedir. Bu çalışma, mevcut uygulamalarda lojistik maliyetlerinin üretim maliyetlerine nasıl entegre edildiğini ortaya koymayı amaçlamaktadır. Ayrıca bu çalışma, lojistik şirketleri, özellikle de liman işletmeleri için maliyetleme yöntemlerinin geliştirilmesine odaklanmaktadır. Bu amaca ulaşmak için bir liman şirketinin lojistik maliyetlerini içeren bir vaka çalışması yapılmıştır. Vaka çalışmasına ek olarak yeni bir maliyet dağıtım modeli önerilmiştir. Çalışmanın sonuçları, lojistik faaliyetlerle ilgili maliyetlerin üretim maliyetlerine entegrasyonunun birçok rekabet avantajı sağlayacağını göstermektedir.

Keywords: *Lojistik maliyetler, maliyet muhasebesi, maliyet yönetimi, maliyet dağıtım modeli*

Jel Sınıflandırması*: D24, M40, M49.*

Makale Gönderim Tarihi: 01.06.2019 **Makale Kabul Tarihi: 01.08.2019**
Makale Türü: Vak'a (Örnek Olay) Çalışması

* This article is an expanded and developed version of the extended abstract proceeding which is presented in the event of MUFAD ISAF 2019, 1-4 May 2019.

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1. INTRODUCTION

In today's competitive environment, where consumers are constantly demanding low prices and high quality, enterprises are trying to determine their costs in the best way and to increase their profitability in order to meet these demands. In order to achieve this, businesses need to thoroughly examine and evaluate their processes. Logistics activities have an important place in business processes. Therefore, there is a need to manage the logistics activities and costs arising from these activities effectively.

Logistical activities may appear to be mainly limited to transport and storage. With the technological progress and the developments brought by the developing world, the area of logistics has expanded and its activities have expanded considerably. In some countries, the costs arising from the logistics activities of enterprises sometimes exceed 10% of the business turnover (Manunen, 2000: 53). Looking at the causes of these costs shows that; transportation, storage, handling, inventory management, order processing, purchasing, packaging and information management activities are considered as the tolerated sacrifices of enterprises for their logistics processes (Ceran and Alagöz, 2007: 157). It is a known fact that these costs will vary from business to business. For example; There are observable differences between the logistic activities carried out in a production enterprise and the logistic activities carried out by an enterprise that mediates. In this sense, it is also possible to come across studies that classify logistics activities with different perspectives. Hacırüstemoğlu and Şakrak (2002: 102) classified logistics activities as storage and material handling, transportation, stocking, information and control and packaging (cited in Tokay et al., 2011).

In today's economic environment, where the competition is highly hardened in terms of enterprises, the management of so many activities on both operational and theoretical is important in many respects. Efficient and productive management of these activities leads businesses to satisfy their customers. Therefore, it is expected that the profitability will increase with the increase in sales potential. It is also possible to take advantage of the economies of scale to reduce costs and therefore to have a stronger competitive advantage against competitors in the context of prices. Efficient and productive management of activities will encourage success in the field. On the other hand, the costs of these activities should be managed with the same efficiency and productivity. It is seen that researchers and managers who have realized this necessity have examined and updated the costing methods in recent years, thus preferring to research or use contemporary costing methods (Pirttila and Hautaniemi, 1995: 327). In particular, it is believed that the activity-based costing method can be used to cost logistics activities (Bokor, 2012: 164).

The activity-based costing (ABC) model aims to identify / allocate costs in an enterprise to products and services by identifying cost pools or event centers. When making these assignments, some distribution keys are determined for the costs. The keys are determined on the basis of the number of events or transactions carried out during the formation of the goods or services laid down (McKenzie, 1999; Stapleton et al., 2004). In this way, it is easier to observe each work and every labor carried out during the production of goods or services according to their scope, and to make them easier to observe based on the costs. This process is easier to observe and the costs are evaluated separately to help the managers to make decisions. As a result, the executives who follow the costs can decide which logistics services will continue to be done by the company or which ones will be

transferred to third party logistics companies. Important decisions for businesses, such as the execution of some well-managed logistics activities through outsourcing, can be taken.

This study aims to reveal how logistics costs are integrated into production costs. In order to achieve this aim, similar studies in this field have been included in the literature. A case study applied to a company which is a major port for Turkey in the later part is included in the methodology. The findings of the study and its results have been proposed suggestions for efficient costing of logistic activities. In addition to case study and suggestions, a new cost distribution model proposed for logistics companies -port companies in particular- . With the existence of proposed model as an alternative to current costing application, this study offers a new effective and useful cost distribution way to understand the unproductive and uneconomic logistics activities.

2. LITERATURE REVIEW

In 1980's, the idea of having more accurate and useful cost information emerged which leads ABC method to reveal (Schniederjans and Garvin, 1997). That idea was focusing on making multiple cost drivers and taking place of traditional cost systems (Kaplan and Anderson, 2007). With changes on costs types and complexity of newly emerged costs, ABC method get supported day by day. Thus allocation of cost by using cost objects and cost drivers became an estimable application (Bokor, 2010; Homburg, 2001). In this part of the study, we investigated current studies about ABC on logistics activities.

Pirttila and Hautaniemi (1995), in their research, presented a proposal on the monitoring of logistics costs by activity based costing method. According to the study, in order to apply this costing method, the relevant cost area and material flow must be documented. After these transactions, detailed information on resources and costs should be established through the current cost information system. The next step of the study is the determination of the operational costs. Finally, these costs are added as cost objects to the goods or services produced. The most important point that the study emphasizes during this process is that the activity-based costing method changes the place where it is distributed, not the costs itself.

Bokor (2012) gave a point to the importance of the costs of logistics activities in production in a study that emphasized the importance of production costing in cost accounting. In order to better observation of these costs, the activity-based costing method used in a case Hungarian business study. According to the results of the research, it is believed that the logistic functions are reflected in the production cost separately. The study also pointed out that it is a highly demanding task to examine the logistics activities through activity-based costing. Stapleton and his colleagues (2004) emphasized that the activity-based costing method is a very valuable method in terms of costing decisions especially for the determination of marketing and logistics costs properly. The implementation of ABC for logistics activities was initiated with the reduction of departmental costs to activities. Then the cost drivers of these activities were determined and it was emphasized that a model should be created for the optimal distribution of these costs.

Manunen (2000) conducted a study on the costing of logistics activities for producers and wholesalers. As a result of the research that constitutes the ABC model, it was

emphasized that enterprises should take into account the whole supply chain to increase efficiency in logistics costs. In this way, it is stated that all customers will get the best value for their money. In particular, the importance of costing is highlighted where logistics costs are higher than competitors.

Themido et al. (2000) also conducted a case study for managing the logistics costs with the ABC. This research, which emphasizes that the ABC has radical differences from traditional costing methods, addresses the advantages of the ABC in terms of combining resources and costs. The study was carried out with an approach that revealed the difficulties and benefits of ABC. When researching and applying ABC method, it is well known fact that cost drivers has a huge impact on the models (Lirkki, 2014). Most of the cost drivers are broadly selected objects and their allocations are based on traditional approaches (Cokins and Capusneanu, 2010; Meng and Tian, 2013). But methods like ABC and developing technology brings some new processes and production matters which leads changes in distribution of costs (Alhola, 2008). Griful-Miquela, (2001) supports that idea by explaining traditional methods' inability of allocating newly considered costs. Studies above which we quoted as literature review (see. Pirttila and Hautaniemi, 1995; Bokor, 2012; Stapleton et. al., 2004; Manunen,2000; Themido et al,2000) have also adopted these opinions but they were not first.

It is believed that this study had a research opportunity since literature review above shows some examples about usage of ABC on logistics costs. Therefore, it was decided to work on a port company which is carrying logistics activities intensely out.

3. METHODOLGY

As a first methodological application of this study, case study method is used as a research method. The case study is a research method that aims to reveal the phenomena on the subjects that are planned to be studied using the various data available (Baxter and Jack, 20008: 544). With the case study, it is desired to obtain results that enable the evaluation of events from different angles. Yin (2003) emphasized that case studies should be used in research to find out why and how. In the studies, it is aimed to explain the case by transferring the obtained data as it is. There are also studies suggesting models to solve the differences seen in cases. In this study, the case study process was carried out in a similar way with the process followed by the studies of Themido and colleagues (2000) which is based on Sheng, (2009) and Singh (2010) studies. According to these studies, firstly the activities were determined. Cost objects were observed through the activities. Resources used in the production of goods or services are discussed. Cost drivers are identified and explained in a logical and measurable way. Finally, the resulting model was evaluated.

Business enterprises involved in the research is a port in Turkey. In general, the case study process was carried out for the logistics costs of this port company and it was presented in the form of schemes. Since the business considered as a service business, the services are considered as production costs. A model for distribution of costs arising from logistics activities proposed after case study concluded. To provide that model, some hypothetical data about revenues and costs of company used to compare the current situation of company's cost distribution of logistics activities with proposed distribution model. Proposed model is also schemed and formulized in the next chapter of this study.

4. FINDINGS

4.1. Case Study

The case analysis, which was established as a result of the interviews conducted with a manager of the port company which has been in service for almost 60 years and observations in the company, provides discovery information about the current state of the business. It has been observed that the company analyzes the costs in general and follows the costing methods. It was emphasized that the analyzes were carried out for the cost of all activities, not only for the costs of logistics activities, but also for the analysis of the costs. It was emphasized that the accounting and finance departments and the administrative and financial affairs departments manage the costs together. In the case study, observations made on the enterprise, it is seen that ABC is used but not used in all its details.

In the study conducted on the port company, the logistics activities of the enterprise and the cost information related to these activities are shown as in Table 1 below. This shows that logistics activities in port operation consist of ro-ro services, container services, bulk general cargo services, storage services, handling services and loading-unloading services. The cost drivers of these activities and the cost sources and the drivers of the activity were transferred in the other columns of the table.

Although the costing table for the enterprise is as follows, the costing method that the company currently uses is exactly the same as in the table below. Accordingly, the company distributes all the costs stated in Table 1 by deducting the income from the related services to total income. This precludes the full observation of the costs of each activity on services.

Table 1: ABC Cost Drivers, Activity Drivers and Cost Objects

Logistics Activities	Cost Drivers	Resources	Activity Drivers	Cost Object
Ro-Ro Services	Service duration, service amount	Workers from subcontractors, fuel from foreign companies, electricity used in lighting	Number of vehicles loaded on board	Service
Container Services	Rental car used, Lux duration, container quaintity and rental duration	Used vehicle, consumed electricity, how long the vehicles are used	Number of containers processed	Service
Bulk-General Kargo Services	Quantity or amount of goods	Subcontracted workers, rented vehicles, duration of vehicles used, number of tugboats etc.	Amount of goods processed	Service
Storage Services	Quantity of storaged goods	the duration of use of the vehicles used and the number of personnel employed, storage period	Used square meters	Service
Handling Services	Handled goods' quantity	Number of employees, materials and tools	Expenditure on goods handling(TL)	Service
Loading-Unloading Services	Quantity of services provided, loading/unloading amounts	number of personnel employed in services, amount of fuel consumed	Amount of goods processed	Service

** It was created based on observations by researchers.*

This information has enabled the establishment of the costing scheme of the enterprise. According to this, a costing map is formed in Figure 1.

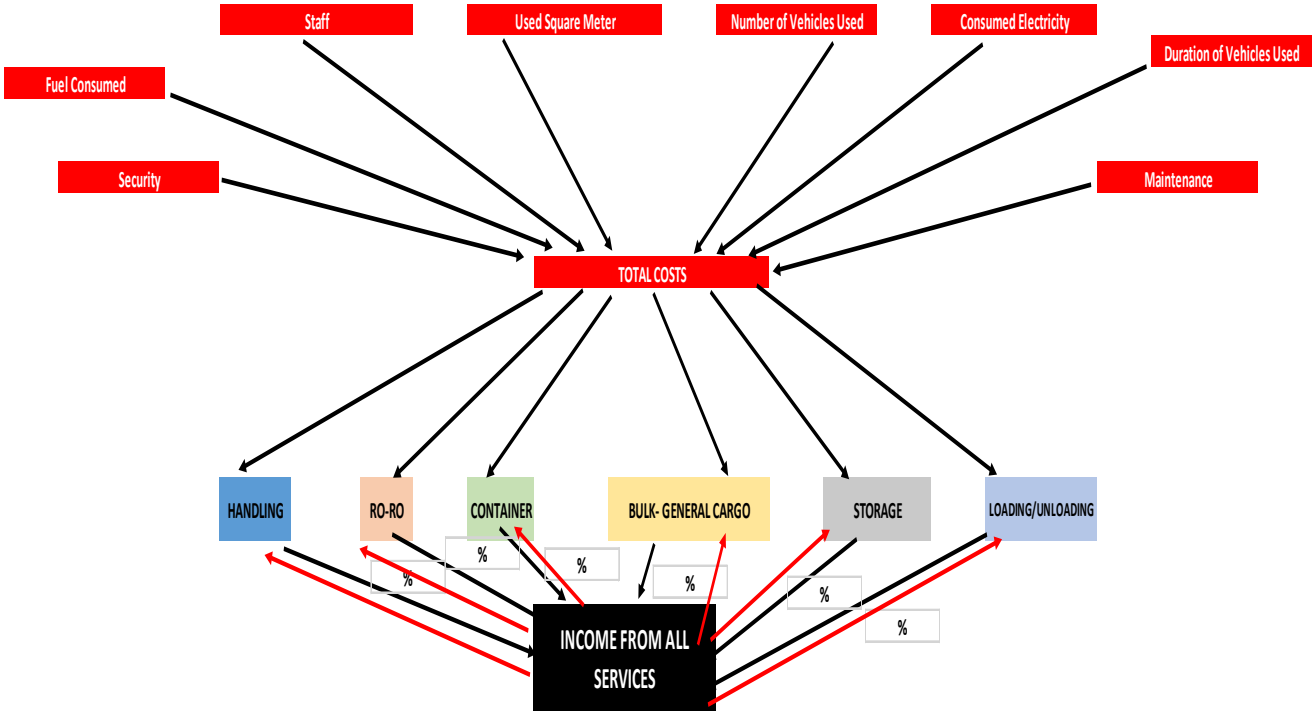

Figure 1: Port Company's Current Cost Distribution Scheme

After seeing the current distribution of costs arising from logistics activities, our study focused on formulization of this distribution. To do that, we used hypothetical data which is roughly estimated by interviews from our case study. Table 2. shows revenues and distributed costs of the company.

Table 2. Data Used in Estimations

Logistic Activity	Estimated Cost Distrubution (TL)	Share in Total Revenue (%)
Ro-Ro Services	**1.799.997**	**15**
Container Services	**2.999.995**	**25**
Bulk-General Kargo Services	**1.799.997**	**15**
Storage Services	**1.799.997**	**15**
Handling Services	**1.799.997**	**15**
Loading-Unloading Services	**1.799.997**	**15**
Total Costs of Logistics Activities	**11.999.980**	
Total Revenue From Logistics Activities	**19.890.990**	**100**

As seen from the Table 1., Figure 1. and Table 2. this company has its own way of ABC model which does not look very effective and useful. The formulization of that information is as follows in Equation 1.:

$$cola_{aLA} = TR_{ALA} \times SOA_{aLA} \quad (1)$$

cola: Cost of Logistic Activity

aLA: Any Logistic Activity (to calculate the cost) (would change accordingly, for example: Ro-Ro Services: *"RRS")*

TR: Total Revenue

ALA: All Logistics Activity

SOA: Share of Logistics Activity

Research findings show that the port company is costing the logistics activities in a simplified way by ABC method. Accordingly, the company has primarily determined the cost drivers for each service. The company transfers all the costs to the determined pool of total costs generated. The cost distribution from this cost pool was determined according to the shares of each logistics activity in total revenues. In other words, it is determined that the costs related to the logistics activities of the enterprise are not clearly transferred to the activities. It is possible to say that this costing performed according to the weight of activities can be associated with the volume of activity. As and example; Ro-Ro services' cost distribution can bee seen as follows in Equation 2 and 3:

$$cola_{RRS} = TR_{ALA} \times SOA_{RRS} \quad (2)$$

$$cola_{RRS} = 19.890.990 \times 0{,}15 \quad (3)$$

Which is equal to: 1.799.997 Turkish Liras

4.2. Model Development

After the examination and evaluation of current cost distribution situation, our study continues with the implementation of our developed model. This model includes a new ABC distribution table which separates detailed costs of logistics activities and distributes them to the related activity. Developed model starts with the Table 3. below which shows roughly estimated costs by unit and unit prices of these costs. Also calculation of these costs are made by two dimensions. First dimension is about logistic activities which is first focus of this study, shows any activities' total costs. Second dimension is about cost drivers which shows total costs of any drivers stratified.

Examples: (Logistic Activity) Total Cost of Ro-Ro Services: 648.420 Turkish Liras (1)

(Cost Driver) Total Cost of Place Rental: 2.160.000 (2)

Table 2: Calculation and Distribution of Costs in Developed Model

Logistic Activity	Place Rental (sq meter)	Vehicle Rental (hours)	Handling Employee (quantity)	Consumed Electricity (kw)	Fuel Consumption (lt)	Handled Containers (quantity)	Total Cost of Activity (TL)
Ro-Ro Services	3.000	720	10	100.000	10.000	**60**	**648.420,00**
Container Services	3.000	720	20	200.000	20.000	**1.500**	**1.536.840,00**
Bulk-General Kargo Services	3.000	720	20	200.000	10.000	**100**	**756.840,00**
Storage Services	10.000	720	20	600.000	500.000	**1.500**	**6.240.520,00**
Handling Services	3.000	720	50	600.000	5.000	**600**	**1.290.520,00**
Loading-Unloading Services	2.000	720	20	200.000	30.000	**1.500**	**1.526.840,00**
Total Unit	**24.000**	**4.320**	**140**	**1.900.000**	**575.000**	**5.260**	**11.999.980**
Unit Costs (TL)	**90**	**250**	**3.000**	**0,5842**	**8**	**500**	**TOTAL COSTS**
Total Cost (TL)	**2.160.000**	**1.080.000**	**420.000**	**1.109.980**	**4.600.000**	**2.630.000**	**11.999.980**

As seen from Table 3. the model developed in this study tries to consider detailed costs and cost drivers about logistics activity. After development of conceptual model, it is thought that schematization of the model would useful to see and show the proposed situation. Figure 2. shows the distribution of costs in new developed model.

Cost drivers and distribution keys (parenthetically) are show on the fist raw of the Table 3. and colorized differently from each other in Figure 2.. In developed model, costs from all drivers are determined and projected to the all logistics activities according to the usage level based calculations. Figure 2. demonstrates that distribution form by showing arrow diagraming method. Colors of arrows are based on the colors of cost drivers. It is believed that the developed model must have a mathematical expression since model showed and explained. Formulization of developed model is as follows in Equation 4.:

$$cola_{aLA} = \left(uc_{PR_{aLA}} \times tu_{PR_{aLA}}\right) + \left(uc_{VR_{aLA}} \times tu_{VR_{aLA}}\right) + \left(uc_{HE_{aLA}} \times tu_{HE_{aLA}}\right) + \left(uc_{CE_{aLA}} \times tu_{CE_{aLA}}\right) + \left(uc_{FC_{aLA}} \times tu_{FC_{aLA}}\right) + \left(uc_{HC_{aLA}} \times tu_{HC_{aLA}}\right) \quad (4)$$

cola: Cost of Logistic Activity

uc: Unit Cost

tu: Total Unit

PR: Place Rental

VR: Vehicle Rental

HE: Handling Employee

CE: Consumed Electricity

FC: Fuel Consumption

HC: Handled Containers

Developed model findings show that if the port company would have used this kind of method, there would be more specific calculations and cost distributions existed. Contrariwise of current costing methods of company, developed model shows distribution ways of costs to the activities. Developed model is not related to the revenues of company but related to the cost sources only. As and example: Ro-Ro Services' cost distribution must be as follows in Equation 5.:

$$cola_{RRS} = \left(uc_{PR_{RRS}} \times tu_{PR_{RRS}}\right) + \left(uc_{VR_{RRS}} \times tu_{VR_{RRS}}\right) + \left(uc_{HE_{RRS}} \times tu_{HE_{RRS}}\right) + \left(uc_{CE_{RRS}} \times tu_{CE_{RRS}}\right) + \left(uc_{FC_{RRS}} \times tu_{FC_{RRS}}\right) + \left(uc_{HC_{RRS}} \times tu_{HC_{RRS}}\right) \quad (4)$$

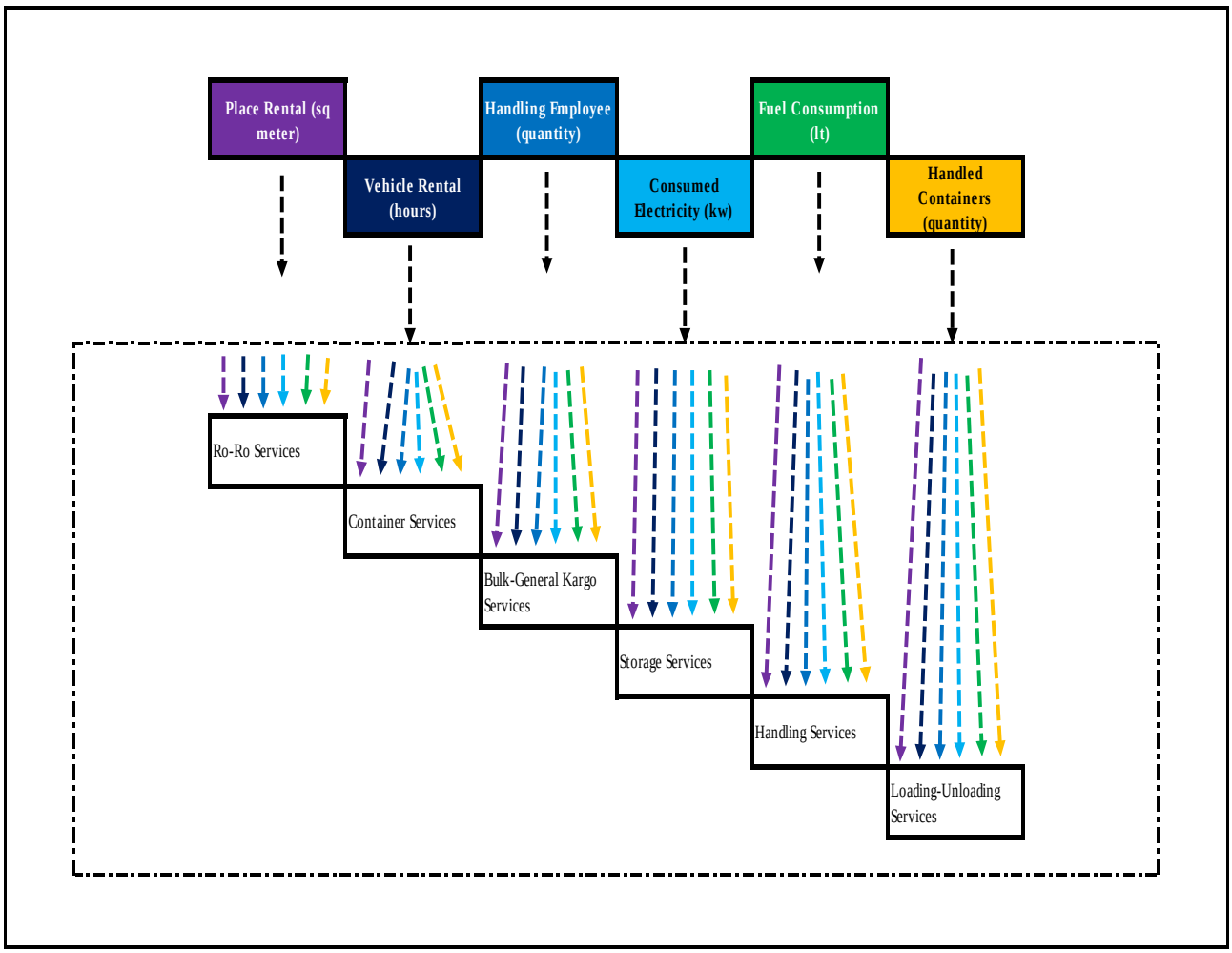

Figure 2: Proposed Cost Distribution Scheme for Port Company

Equation 5. leads us to:

$$cola_{RRS} = (90 \times 3000) + (250 \times 720) + (3000 \times 10) + (0{,}5842 \times 10000) + (8 \times 10000) + (500 \times 60) \quad (5)$$

Which is equal to: 648.420 Turkish Liras

Since current findings and developed model proposal are assessed, necessary discussions and results will be approached in the next chapter.

5. RESULTS AND DISCUSSION

Research findings show that the port company is costing the logistics activities in a simplified way by ABC method. Accordingly, the company has primarily determined the cost drivers for each service. The company transfers all the costs to the determined pool of total costs generated. The cost distribution from this cost pool was determined according to the

shares of each logistics activity in total revenues. In other words, it is determined that the costs related to the logistics activities of the enterprise are not clearly transferred to the activities. It is possible to say that this costing performed according to the weight of activities can be associated with the volume of activity.

The costing method applied by the company does not make clear all the costs of each logistics activity. This avoids the correct costing of activities. Therefore, it is believed that there will be no transparency in making financial decisions regarding the management of logistics activities. The fact that the logistics activities of the enterprise as well as the services offered to the customers are increasing the importance of the costing systems in this company. After all, there will be obstacles in carrying logistics activities out because of the poor reporting of important costs.

From this point of view, a study opportunity has occurred. Revealing and examining current inefficient costing method in the findings converged this research to offer a new solution. As soon as inefficient and fuzzy costing method of the company recognized, we constructed a new costing analysis which is carried out by a whole new model for this company. It is believed that the enterprise has needed to implement an ABC model that will accurately distribute its costs on the basis of every logistics activity. From our case study as preliminary preparation for the enterprises and the researchers for their subsequent work we developed new costing scheme.

Developed distribution scheme and calculations showed that there are many differences between activities' potential real costs. First of all current method of the company distributes costs to activities by their shares in revenues which disrupts examining real costs. Secondly real cost drivers of the activities are not clear even do not exist. Last but not least first and second issues are real big problems for managerial accounting of logistics activities. On the other hand, developed model brings some transparency to costing applications. As shown on the findings, there are real differences between to model. In developed model every logistics services has different costs then current model. Reason of these differences is because company skips to consider detailed cost drivers. That does not mean that the company does not know its' costs. We emphasize that cost drivers are not considered as an object of managerial accounting in this case. As a conclusion we believe that our model is a proper start to examine detailed costs about logistics activities. With models like that both logistics activities and cost drivers about them can be analyzed properly so that efficient and profitable management of costs can be done. However with the help of these kind of applications, managerial decisions can be done more easily. Understanding and examining of real costs and drivers brings alternative decisions like outsourcing, to the managers. With the findings of the research, and the model proposal we believe that there will be and must be more studies about cost of logistics activities made in future studies. Also we suggest to the practitioners to consider using advanced and transparent cost distribution techniques to reveal what is really important for cost dynamics of businesses.

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