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An ABC analysis for power generation project

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A B S T R A C T

One of the primary concerns on performance measurement is to know how much a particular project cost. However, using traditional method on project-based products often leads to inappropriate results. In this paper, we re-examine this issue by comparing the cost of a power station construction project using ABC versus traditional method. The results of survey show that ABC method is capable of providing better estimates for overhead costs compared with traditional method. In other words, ABC method helps reduce some of the unnecessary overhead cost items and increase on some other cost components. This helps increase the relative efficiency of the system by reducing total cost of project.

1. Introduction

During the past fifty years, there have been significant efforts on developing appropriate methods for measuring the cost of projects. According to Cooper and Kaplan (1987) in order to make suitable decision such as optimal pricing strategy, one needs to locate the cost of product. There are two primary methods for measuring the cost of project- based products: traditional versus activity based cost (ABC) methods (Agrawal & Mehra, 1998; Cooper & Kaplan, 1992). The first one assumes different products consume the same amount of overhead expenditures but ABC method considers details of overhead cost and using an appropriate cost driver, the method provides more precise figure for the cost of project-based products. During the past few years, there have been different studies to verify whether there is any difference between the traditional cost account and ABC method. According to Tsai (1996) ABC is developed to improve the accuracy of product expenditure data derived from the traditional cost system. ABC transforms overhead costs in the traditional cost system into direct costs by using activities as the intermediums of cost assignment. ABC keeps tracking indirect expenses to the activities and then assigns the activity costs to the products. ABC

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has been widely used in the practice and investigated in the literature. According to Ben-Arieh and Qian (2003), ABC has become a reliable cost estimation and accounting methodology and using ABC for cost estimation of manufactured parts is being used today with acceptable rate of success.

Baykasoğlu and Kaplanoğlu (2008) presented an application of ABC to a land transportation company in Turkey where they combined ABC with business process modeling and analytical hierarchy approach (Saaty, 1990). Although there are enormous studies on explaining modern costing approaches including ABC methods, the number of studies that consider real life applications is very few and this assumption holds for logistics and transportation applications. In land transportation companies, the problem is to determine and to evaluate true cost of their operations and services and ABC capable us for transportation companies to determine cost of their operations with higher correctness (Johnson & Kaplan, 1987).

Makeli et al. (2012), for instance, presented an empirical study the measure the effects of different items on the cost of e-learning programs. They gathered the necessary cost components of three governmental universities located in city of Tehran/Iran and chose ten different cost items for their analysis and using some statistical test determined the most important ones. They reported that seven cost items played essential role on determining the cost of e-learning including utilities, internet connection and network, employee payment, software & licensing, payments of instructors and their assistants, hardware equipment and other overhead expenditures. They reported that the proposed approach was quite effective in costing services of the land transportation company compared with the existing traditional costing system, which is in use.

Gunasekaran and Sarhadi (1998) discussed different issues associated with the implementation of ABC in manufacturing. They explained that new productivity and quality improvement strategies could increase in the awareness of ABC in present day manufacturing organizations and an appropriate framework for the management of productivity and quality. Nachtmann and Al-Rifai (2004) explained that under certain operating conditions, ABC system is able to provide relevant and accurate indirect cost information that helps in making customer, product, and process improvement decisions.

Pohlen and La Londe (1994) discussed how ABC assigns overhead costs and presented the results of an exploratory study examining ABC implementation specifically within logistics. Raz and Elnathan (1999) presented an application of ABC method for cost estimation in project-based organizations. The model included a cost allocation structure designed specifically for projects, and a number of cost drivers for typical project activities. They concluded with a discussion of some issues involved in the implementation of ABC, and of activity-based management.

Cohen et al. (2000) developed a technique for an ABC analysis in an academic radiology department, to examine the hypothesis that the business of academic radiology can be separated into three distinct businesses—clinical activity, teaching, and research—and to detect the impact of the current teaching paradigm on clinical productivity. They provided a successful insight of the relative costs of each of the businesses of teaching, research, and clinical activity. They also provided the departmental costs of performing the separate activities typical of each business.

Rezaie et al. (2008) used ABC approach together with traditional costing (TC) for parts costing in flexible manufacturing systems (FMS) with the A(2) level of automation. They presented a new model for the implementation of ABC based on the product cost tree concept. In their work, they first recorded the required resources and activities for each part and then their expenses were measured based on some scales. The model was used in a forging industry. They reported that ABC outputs were more reliable than the TC outputs, and recommend using ABC approach.

2. The proposed method

In this paper, we present the implementation of ABC method for power station construction project located in city of Zanjan, Iran. The project consists of six components namely the cost of purchasing equipment, buying transformers, engineering services, construction, laboratory services and purchase of land. The proposed model of this paper consists of eight different stages and we present it in our case study. The first stage is associated with cost components and cost drivers. Table 1 demonstrates a summary of all cost items, which influence the cost of project.

Table 1
The summary of cost driver and cost items

Cost item	Cost	Cost driver
Personnel costs	1,542,039,916	Number of staff
Administrative and organizational costs	203,588,328	Number of staff
Maintenance cost	95,877,058	Number of vehicles
Transportation cost	17,720,409	Distance and weight of shipment
Costs for services received from contractors	77,869,673	Percentage of services
Total	1,937,095,386	

Next, we need to determine the main activities associated with each part and Table 2 demonstrates a summary of our findings.

Table 2
The summary of main components of the project

Main activities	Cost driver
Management and supervisors	Person-day
Design and engineering	Person-day
Technical Inspection	Person-day
Procurement and Supply	Cost of materials used
Technical Service and Support	Services provided
Administrative	Person-day
Inventory	Value of services provided
Project control	Person-day

Next, we need to determine Expense-Activity-Dependence (EAD) matrix to show the relationship between different cost components and cost drivers. These relationship are shown in Table 3 as follows,

Table 3
Expense-Activity-Dependence (EAD) matrix

Cost	Activity				
	Personnel costs	Administrative and organizational costs	Maintenance cost	Transportation cost	Costs for services received from contractors
Management and supervisors	√	√	√		
Design and engineering	√	√	√		√
Technical Inspection	√	√	√		√
Procurement and Supply	√	√		√	
Technical Service and Support	√	√			
Administrative	√	√			
Inventory	√	√	√		
Project control	√	√			

Next step is to provide the cost of each item in each department and Table 4 shows details of our cost components.

Table 4
The cost of different items

	Employee cost		Administration cost		Maintenance cost		Transportation	service
	#	cost	#	cost	#	cost		
Management and	2	205605322	2	27145110	1	15979509	0	0
Design and engineering	3	308407983	3	40717665	1	15979509	0	38934836
Technical Inspection	2	205605322	2	27145110	2	31959019	0	38934836
Procurement and Supply	2	205605322	2	27145110		0	17720409	0
Technical Service and	1	102802661	1	13572555		0	0	0
Administrative	2	205605322	2	27145110		0	0	0
Inventory	2	205605322	2	27145110	2	31959019	0	0
Project control	1	102802661	1	13572555		0	0	0

After normalizing the information in Table 4 in terms of each column, we use the following problem statement,

$$TCA(i) = \sum_{J}^{M} E(j) \times EAD(i, j)$$

where M represents total numbers of cost items, E(j) is the cost of j^{th} component and *EAD(i,j)* is Expense-Activity-Dependence (EAD) matrix. Table 5 demonstrates the results of our computations.

Table 5
The summary of cost of each department based on different cost drivers

	Employee cost	Administration	Maintenance	Transportation	Contractors	Sum
Management and supervisors	205605322	27145110	15979509	0	0	248729941
Design and engineering	308407983	40717665	15979509	0	38934836	404039993
Technical Inspection	205605322	27145110	31959019	0	38934836	303644287
Procurement and Supply	205605322	27145110	0	17720409	0	250470841
Technical Service and Support	102802661	13572555	0	0	0	116375216
Administrative	205605322	27145110	0	0	0	232750432
Inventory	205605322	27145110	31959019	0	0	264709451
Project control	102802661	13572555	0	0	0	116375216
Total	1,542,039,916	203,588,328	95,877,058	17,720,409	77,869,673	1,937,095,386

Now, we are ready to compute Activity-Product-Dependence (APD) matrix and show how much resource each department consumes and then based on APD rates we can determine overhead cost for each activity. Table 6 shows the results of our computations based on traditional (TC) and ABC methods.

Table 6

Activity	ABC	TC	Difference
Land acquisition	47254340	180682901	-133428561
Purchasing equipment	1136225380	922748923	213476457
Buying transformers	279147543	357488112	-78340569
Engineering services	30791035	168925977	-138134942
Laboratory	1539552	481827	1057725
Construction operation	442137529	306767646	135369883

As we can observe from the results of Table 6, there is a significant difference between ABC method and traditional one in terms of land acquisition, purchasing transformers as well as engineering services.

3. Conclusion

In this paper, we have presented an empirical investigation to estimate the cost of power station construction project located in city of Zanjan, Iran based on the implementation of both traditional as well as ABC method. The project consisted of six components namely the cost of purchasing equipment, buying transformers, engineering services, construction, laboratory services and purchase of land. The proposed model of this paper consists of eight different stages and we present it in our case study. The results indicated that ABC method was able to find better cost estimation compared with traditional method. ABC method is generally recommended when overhead costs are significant compared with total cost. In other words, when a big portion of cost of a product is associated with overhead cost, we need to figure out about the precise expenses so that we could manage project, properly. In our case study, overhead costs were accounted as nearly 20% of total cost of project and this justifies using ABC against traditional cost method. Nevertheless, using ABC method could be time consuming and needs a major participation of different groups in this project, which means that management team needs to set aside time and energy for using ABC method. Therefore, we recommend using ABC method only when the cost of computation is negligible compared with the results of ABC implementation.

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