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Utilizing Activity Based Costing Model for Cost Management in Iranian Gas Companies

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ABSTRACT

This research explains the steps and the benefits of implementing Activity Based Costing (ABC) in Iranian Gas Company. Using ABC, cost of one cub meter of consuming gas in all regions of capital was determined and compared with the results of the Traditional Costing Systems (TCS). Implementing ABC strongly changed company managers' prospective toward company cost of services, provided more effective system for company internal decision-making, improved the effectiveness of the costing system and cost management and helped the managers to correct company pricing of services and accomplishment of the strategic goals by giving correct cost information.

Introduction

Nowadays, organizations are involved in situations that are more complex. Things like tight competitions in market, economic fluctuations, and day-to-day crisis in international ties, the fast progress of technology in most of the fields, sensitivity of human resources in organizations and many other problems have made running the organizations more difficult. Sometimes, management has changed from "a decision for a life" to "a decision for a day". Companies for their survival should set prices in a way that they can compete to others in present markets and at the same time prices guarantee their contribution margin. For this purpose, they should develop effective mechanisms for measuring their performances and for the correct report of costing.

Due to changes in technology, a considerable share of product costs is allotted in overhead costs and consequently an appropriate allotment of overhead costs to products and services regards as a very important matter for all kinds of organizations. Since Traditional Costing System (TCS) utilizes optional bases (such as direct work hour) to share out the overhead costs and ignores the causal relations between used direct work hours and overhead costs, it is weak on allocating and setting costs and can't be accountable for present management needs. As a result, management accountants in order to provide the managers accurate information for optimal decisions in competitive situations have introduced costing based on activity system for calculating cost of products and services. (Hejazi, 2005)

The Islamic Republic of Iran, due to its geo-strategic situation being between the two biggest natural gas rich regions (Soviet Union and the countries around the Persian Golf). Iran is possessing more than 27 trillion cubic meters of natural gas that is considered as the second greatest owner of natural gas resources after Russia. Based on most of the reliable estimations, natural gas because of its inherent properties and especially its adaptation with the environment is one of the energy carriers that will have the highest progress rate among other energy carriers by year 2030. It means that natural gas share of the world's energy consuming basket is continuously increasing. (Khatibi & Tabatabiye, 2006) It is why pricing the natural gas is one of the most important and basic issues in economy of a society. Also, maintenance and appropriate consumption of hydrocarbon resources which are also part of the rights of prospective people increase the importance of gas costing and pricing on the macro level. It is because, the revenue resulting from appropriate pricing of natural gas in every consuming sector will have an influence on not only gas industry interests but also on national and economical interests of the country at the present and in the future. Accordingly, logical and appropriate pricing of natural gas industry, like other industries, should be according to the economical principles and standards. It is well known that in pricing natural gas, several factors such as environmental, social and political considerations as well as its cost should be taken into account. Awareness of the economical cost for setting the economical price of the natural gas is one of the necessary principles in gas pricing model.

In this research, in order to have a model for the correct and exact calculation of the cost of every one cubic meter of the natural gas in different regions, Activity Based Costing (ABC) as a case study was carried out in Tehran Province Gas Company. For this purpose, the structure of remaining sections of the paper are as follows. Next section summarizes the literature on ABC in services and gas industries. Section 3 explains the research methodology. Section 4 provides the

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discussions and the result of the analysis. Finally, the paper ends with conclusions and final remarks.

Literature Review

Most of studies reveal that ABC system is a useful method for the evaluation of sectors managers' performances, estimation of resource (budget) consumption along the line of giving services, appropriate allocation of resources among public sectors and increase of the quality of the services of public sectors in the central government.

Baxendale and Dornbush (2000) in a study named "ABC for hospice" calculated cost and solutions for decreasing costs in the central hospice of Kentaki. The management of this hospice believes that when the expenses increase, implementing management accounting methods is the only solution for decreasing costs. After studying and counseling with specialists, the management introduced ABC as the most helpful system. In this study, they identified main activities in hospice, grouped the activities, and determined the activities necessary for delivering services to the customers. Results of the study showed that ABC with presenting accurate information about costing has helped the management to decide about decrease of costs, improvement of process, increase of quality, and correct pricing of services.

Tatikonda and Tatikonda (2001), Ellis-Newman et al. (1996), and Mitchall (1996) in a similar research introduced ABC as a good method of performance evaluation, allocating resources, improving process and increasing efficiency of activities in universities. Kelline et al. (2001) and Roberson and Bernasooni (1998) studied the importance of ABC in correct budgeting of university. This study with the application of ABC in the university of Kansas state showed that it in different parts of university can have the following applications:

- Conformity of resources with the units' purposes
- Increasing efficiency of activities and works in different parts
- Presenting logical reasons to college and university chancellors about correct method of resources consumption and using more resources if necessary
- Using logical method of organizing information in units

University chancellors with implementation of ABC understood that this system in comparison with the TCS is more helpful for budgeting, allocating resources to different parts and also evaluating performances and decision making in attention to costs information.

Lung (2002) in a study named "ABC in Telecom Industry" studied telecom corporations in Australia, Ireland and Panama. They used ABC for costing telephone conversations and setting prices. The results showed that ABC with presenting correct information about the final costs and good pricing led to customers' satisfaction and firms' profitability increase.

Jarvinen (2005), Arnabodia & Lapsly (2005) , Arnaboldi & Lapsly (2004) , Negrini et al. (2004), Waters et al. (2003), and Rajabi (2001) implemented ABC in different hospitals in the world and introduced this system as a strategy for the correct allocation of direct overheads to products and presentation of helpful information for managers' decision making in competitive situations.

Sap et al. (2005) in a research named “Activity based costing in financial institutions” calculated cost of services in the United States bank. In this study, the reasons for the need of financial institution to exact and complete information about their cost of services are as follow:

- *Deregulation of financial institutions:* Deregulation has intensified competitive pressures on pricing, product mix, delivery, and profitability.
- *Increase in the cost of interest-bearing sources of funds:* This has increased the need for cost information in order to price loans profitably in light of shrinking margins.
- *Expansion of non-fund services:* The introduction of new, non-traditional products and services has complicated the cost\structure and has increased the need for accurate cost information in order to design and price these products and services.
- *Unbundling of products and services:* In days past, banks often relied on a single service charge to cover a bundle of services and hoped that on average the total cost of providing services cost less than the revenue generated by the service charge. The trend over recent years has been to unbundled services and prices, each one separately. This has significantly increased the demand for cost information.
- *Automation of many transactions:* While technology has lowered the direct cost per transaction, it has increased the indirect costs. The tracing of these indirect costs to products is a major challenge for a cost system.

Kocakülâh and Crowe (2005), Narasimha and Thampy (2002), Mostaque and Gunasekaran (2001), Innes and Mitchall (1997) with the application of ABC in banking industry, introduced this technique as the one that meet managers information needs and help them to have a correct understanding of costs of services.

Ju Kim (2003) in a study named “Activity based costing in telecommunication industry” calculated cost of internal telephone conversations. The implementation of the ABC in this study was as follow:

- Measuring work hours, statistical data and production
- Identifying activities in every unit
- Determining cost drivers.
- Separating cost lacking tariff from cost having specific tariff.
- Codifying based on product unit, recording and measuring statistical data for separating direct costs from indirect costs.
- Allocating indirect costs based on drivers

The results indicated that ABC gives a useful basis for sharing out common costs in telecommunication industry and helps the managers to set the correct price of internal telephone conversations and determine exact loss and profit of the company. Moreover, for the successful implementation in industry, it is necessary to use information technology for measuring statistical data and correct classifying of assets.

Taherkordi (2003) in a study named “The implementation of the activity based costing in Oil Company of Iran continental shelf” calculated cost of one oil barred production of the company. The results indicated that ABC with revealing some of the problems and quantifying company operations make useful information available to optimize operations. Therefore, managers can improve efficacy of their operations by activities and lower the costs.

Muras et al. (2000) believed that ABC was necessary for improvement of process application of managers' goals, standardization and correct pricing of product in oil industry.

Barton and Macarthur (2003) in a research named "ABC and predatory pricing: the case of the petroleum retail industry" indicated that final costs of each gallon of petrol based on ABC in comparison with the pervious methods were more accurate and more clear. They show that ABC technique solved the

problems when the final costs of the products are less or more than the real amount.

Arabmazar Yazdi and Naseri (2004) use ABC in banking deposit services. Ellis-Newman (2003) in a study named "ABC in user services of an academic library" in library of Australian university showed that libraries' managers for strategic planning and deciding about the optimal allocation of rare resources needs information about costs behaviors that the best method for understanding this issue and improving costing system is ABC. Detya (2001), Ellis and Robinson (1998) in similar researches evaluated ABC as a helpful technique for the activities of libraries' managers.

Lievens et al. (2003) in a study named "ABC for cost calculation in radiotherapy" calculated radiotherapy costs. These costs include equipment costs, which are one of overhead costs in each therapy that their correct tracing to products show correct and precise final cost. Therefore, for the correct allocating of such costs and setting final cost of one day or long-term cures, ABC was used. The management of this center after the application of this system introduced ABC as a strong method in setting final prices of services that correct pricing.

Collier (2006) in a study named "Costing of police services " calculated the cost of every crime committed using ABC. In that study with considering the new approach of the management of the public sector toward the rate of resource consumption against services and the importance of police as the supplier of social security, ABC for costing police services has been implemented in England and Wales. The results had considerable benefits for both police and related government because of identifying the activities lacking valued added resulted in process improvement and decrease of organizations. In addition, the research showed that for giving services, it is essential to profit from more resources.

Kumar (2006) in a research named "Activity based costing in hospital" calculated cost of services in the blood transfusion ward of the American national hospital. With the implementation of the system there, American national hospital managers and directors become aware of the benefits of the ABC in improvement of activities and increase in efficiency. Moreover, according to the researcher, support of the high management, company resources and strategies, good and attractive introduction of the system to the organization and having competitive and instructive environment were among the effective factors that made the implementation of this technique successful.

According to the literature, ABC brings the following advantages:

- ABC with presenting accurate information about costing helps the management to decide about decrease of costs, improvement of process, increase of quality, and correct pricing of services.
- ABC as a good method of performance evaluation allocates resources, improves process, and increases efficiency of companies' activities.
- It is helpful for budgeting, allocating resources to different parts of company and evaluating performances and decision making in attention to costs information.
- It presents correct information about the final costs and good pricing and leads to customers' satisfaction and increases firms' profitability.
- It is a helpful tool for correct allocation of direct overheads to products and presentation of helpful information for managers' decision making in competitive situations.
- It reveals some of the problems and quantifying company operations make useful information available to optimize operations. Therefore, managers can improve efficacy of their operations by activities and lower the costs.
- It is a strong method in setting final prices of services and correct pricing.
- It identifies the activities lacking value added in process improvement.

Research Methodology

Transforming natural gas to the final customers includes some stages as discovery, development and production, transfer and distribution. In this research, in order to calculate cost of services in gas transfer sector, ABC was used. It was examined in Tehran Gas Company as a case of study in the oil and gas industry of Iran. In sampling from Provincial Gas Companies under the supervision of Iran National Gas Company, Tehran Province Gas Company, which is the biggest provincial gas companies, was selected. Because of the availability of the real information about the year 2005, we have calculated cost of one cube meter of natural gas in all regions of the Tehran province for the year of 2005.

In our study, ABC includes the following eight stages:

Stage 1: Determining cost items and cost drivers: These items are determined by using the company accounting system. The cost items are costs groups of the company included in the profit and loss list. Cost drivers show causes of resources consumption by activities. These cost drivers can be determined using opinions of the managers of the financial affairs.

Stage 2: Identifying main activities and determining cost drivers: In order to identify the main activities, we used of operational process chart, interview with the experts and the researchers. After identifying activities, with attention to the considerations about benefits which were higher than expenses, similar activities put together and related cost drivers were determined. Table 1 shows the main activities, cost drivers and cost items for the company.

Stage 3: Determining the relation between cost items with activities in the Expense-Activity– Dependence Matrix (EADM): This matrix shows how resources consumed by each activity.

Stage 4: Calculating and replacing allocation rates in the EADM: Based on the cost drivers, which are determined in stage 1, share of each activity of company from resources was calculated and put in the matrix cell. According to the calculated numbers, allocation rates of cost items to activities were calculated and placed in matrix cells. Sum of rates in each column of EADM should be equal to one. This matrix is based on the real information in the years 2003, 2004, and 2005 because in Tehran Gas Company, just the financial information of these 3 years was available. The average of allocation rates over three years considered as final rates of resources consumed by activities.

Stage 5: Calculating activities' expenses: Activities' expenses are calculated by the following formula:

$$TCA(i) = \sum_{j=1}^{m} \{E(j) \times EDAM(ij)\} \qquad (1)$$

Where *TCA (i), m, E (j),* and *EDA(i,j)* denote the total expenses of activity, number of cost items, the rate of consuming resources by activity and *i*the row and *j*the column in EADM, respectively. After calculating cost of each activity, the new matrix of EADM with monetary values was formed. Table 2 shows completed Expense-Activity–Dependence Matrix (EADM).

Table 1. Company main activities-cost drivers and cost items-cost drivers,

Row	Cost items	Cost drivers	Main activities	Cost drivers
1	Salary & wage	Cost center personal	Engineering	Net work size
2	Goods	Monetary value of orders	Transportation	Number of automobiles
3	Receivable services	Monetary value of services	Telecommunication	Number of telephone lines
4	Other costs	----------	Measuring & distribution of gas	Number of stations
5	Depreciation	Monetary value of resources	Main subscribers	Number of main subscribers
6	Water& power bill	Monetary value of payments	Computer	Number of computers
7	Automobile rent	Monetary value of transport fare	Sustaining	Number of personnel
8	Training	Training hour		
9	Administrative& organization	Monetary value of office services		

Table 2. Expense-Activity–Dependence Matrix (EADM)

Activities / Cost items	Engineering	Transportation	Telecommunication	Main subscribers	Measuring& distribution of gas	computer	sustaining	Sum
Water& power bill	24.03%	0.74%	5.27%	3.67%	1.09%	1.49%	63.72%	100%
	102,796,908	3,156,869	22,543,392	15,682,806	4,669,814	6,353,523	272,596,954	427,800,266
Automobile rent	3.15%	91.78%	0.04%	0.54%	0.19%	0.21%	4.08%	100%
	25,534,931	742,938,232	325,615	4,385,466	1,556,946	1,706,451	33,035,763	809,483,350
Administrative and organization	51.70%	2.31%	0.06%	9.97%	2.34%	3.95%	29.13%	100%
	1,860,996,372	83,303,263	21,751,257	358,799,825	84,135,722	142,254,704	1,048,533,883	3,599,775,145
Other costs	6.67%	6.21%	0.02%	6.02%	0.19%	0.11%	79.79%	100%
	38,797,835	31,428,926	107,224	30,432,566	952,872	534,416	403,418,157	505,871,997
Salary& wage	10.46%	0.70%	0.52%	1.64%	0.43%	1.02%	85.24%	100%
	6,553,573,565	440,124,964	326,148,707	1,025,534,346	269,095,466	636,456,931	53,423,131,635	62,674,063,524
Depreciation	2.21%	31.70%	0.55%	53.98%	0.06%	2.59%	8.99%	100%
	792,520,180	11,831,689,875	207,083,767	20,150,196,286	23,106,234	967,982,783	3,355,845,143	37,328,425,512
Receivable services	20.11%	1.66%	0.39%	3.08%	0.75%	1.95%	72.06%	100%
	2,152,116,574	177,603,634	41,477,783	329,711,141	80,478,473	208,457,974	7,710,029,761	10,699,875,698
Training	35.29%	1.62%	12.33%	10.97%	5.93%	2.64%	31.23%	100%
	149,796,038	6,855,694	52,315,946	46,546,567	25,161,248	11,208,906	132,579,091	424,463,490
Goods	17.28%	9.73%	1.30%	2.32%	0.53%	8.26%	60.59%	100%
	335,988,951	189,289,077	25,271,335	45,140,835	10,244,595	160,553,139	1,178,405,418	1,944,893,350
Total	12,011,891,617	13,506,261,257	697,008,847	22,006,399,407	499,394,708	2,135,399,310	67,556,973,516	118,413,328,662

Table 3. Activities- product- dependence matrix (APDM)

Row	Activities / Regions	Sustaining	Computer	Measuring& distribution of gas	Main subscribers	Telecommunication	Transportation	Engineering
1	Eslamshahr	8.79%	9.94%	5.29%	2.02%	7.57%	6.35%	5.90%
2	Pakdasht	2.20%	3.51%	11.06%	38.87%	8.37%	6.35%	5.51%
3	Pishva	4.40%	1.75%	0.96%	1.62%	2.39%	3.17%	1.48%
4	Damavand	2.20%	4.09%	1.44%	0.40%	5.58%	3.17%	3.30%
5	Robat karim	3.30%	2.34%	3.37%	0.81%	1.59%	3.17%	2.69%
6	Gharchak	2.20%	2.34%	1.44%	11.34%	2.39%	3.17%	2.81%
7	Vavan	0.55%	1.75%	0.96%	0.20%	1.20%	1.59%	0.86%
8	Varamin	11.54%	14.62%	6.73%	2.83%	8.76%	9.52%	5.85%
9	Eshtehard	1.65%	0.58%	1.44%	3.85%	3.19%	3.17%	0.52%
10	Shahregods	3.30%	4.68%	1.92%	3.04%	4.78%	4.76%	3.29%
11	Shahriyar	7.69%	7.02%	5.29%	0.61%	3.59%	7.94%	6.91%
12	Fardis	4.95%	2.92%	10.10%	1.82%	1.99%	6.35%	6.86%
13	Karaj	28.57%	22.81%	25.48%	11.94%	25.50%	17.46%	30.42%
14	Nazarabad	3.85%	2.92%	3.37%	4.05%	1.59%	4.76%	5.19%
15	Vardavard	2.20%	2.34%	0.48%	0.81%	2.79%	1.59%	2.08%
16	Hashtgerd	4.40%	3.51%	2.88%	0.61%	3.59%	6.35%	2.90%
17	Bagherabad	0.55%	0.58%	1.44%	0.20%	0.80%	1.59%	0.78%
18	Gheyamdasht	1.10%	2.92%	0.48%	0.20%	7.57%	1.59%	0.59%
19	Chahrdange	0.55%	2.34%	3.37%	13.97%	0.40%	1.59%	5.28%
20	Rodehen	1.65%	1.17%	2.40%	0.40%	3.19%	1.59%	1.82%
21	Golestan	1.65%	2.34%	4.33%	0.20%	0.40%	1.59%	0.20%
22	Nasimshahr	1.65%	1.75%	1.92%	0.00%	1.59%	1.59%	2.19%
23	Malard	1.10%	1.75%	3.85%	0.20%	1.20%	1.59%	2.55%
	Total	1	1	1	1	1	1	1

Table 4. APDM with monetary items

Row	Regions	Sum of Indirect Overhead	Sustaining	Computer	Measuring	Main Subscribers	Telecommunication	Transportation	Engineering
1	Eslamshahr	8,242,049,347	5,939,074,595	212,291,159	26,410,297	445,473,672	52,761,626	857,540,397	708,497,600
2	Pakdasht	11,745,367,432	1,484,768,649	74,926,292	55,221,530	8,553,094,506	58,315,481	857,540,397	661,500,577
3	Pishva	3,991,557,873	2,969,537,297	37,463,146	4,801,872	356,378,938	16,661,566	428,770,199	177,944,855
4	Damavand	2,532,943,923	1,484,768,649	87,414,007	7,202,808	89,094,734	38,876,988	428,770,199	396,816,538
5	Robat karim	3,234,874,982	2,227,152,973	49,950,861	16,806,553	178,189,469	11,107,711	428,770,199	322,897,217
6	Gharchak	4,819,327,433	1,484,768,649	49,950,861	7,202,808	2,494,652,564	16,661,566	428,770,199	337,320,786
7	Vavan	783,808,021	371,192,162	37,463,146	4,801,872	44,547,367	8,330,783	214,385,099	103,087,591
8	Varamin	10,814,242,910	7,795,035,406	312,192,882	33,613,105	623,663,141	61,092,409	1,286,310,596	702,335,372
9	Eshtehard	2,493,669,073	1,113,576,487	12,487,715	7,202,808	846,399,977	22,215,421	428,770,199	63,016,466
10	Shahregods	4,076,828,473	2,227,152,973	99,901,722	9,603,744	668,210,508	33,323,132	643,155,298	395,481,095
11	Shahriyar	7,433,833,655	5,196,690,270	149,852,583	26,410,297	133,642,102	24,992,349	1,071,925,497	830,320,557
12	Fardis	5,550,306,883	3,340,729,460	62,438,576	50,419,658	400,926,305	13,884,638	857,540,397	824,367,849
13	Karaj	28,735,072,635	19,301,992,433	487,020,895	127,249,613	2,628,294,666	177,723,371	2,358,236,093	3,654,555,564
14	Nazarabad	4,846,620,943	2,598,345,135	62,438,576	16,806,553	890,947,344	11,107,711	643,155,298	623,820,325
15	Vardavard	2,198,714,507	1,484,768,649	49,950,861	2,400,936	178,189,469	19,438,494	214,385,099	249,581,000
16	Hashtgerd	4,423,988,286	2,969,537,297	74,926,292	14,405,617	133,642,102	24,992,349	857,540,397	348,944,232
17	Bagherabad	749,435,505	371,192,162	12,487,715	7,202,808	44,547,367	5,553,855	214,385,099	94,066,497
18	Gheyamdasht	1,189,369,406	742,384,324	62,438,576	2,400,936	44,547,367	52,761,626	214,385,099	70,451,477
19	Chahrdange	4,363,706,902	371,192,162	49,950,861	16,806,553	3,073,768,338	2,776,928	214,385,099	634,826,961
20	Rodehen	1,694,872,895	1,113,576,487	24,975,431	12,004,680	89,094,734	22,215,421	214,385,099	218,621,042
21	Golestan	1,470,661,874	1,113,576,487	49,950,861	21,608,425	44,547,367	2,776,928	214,385,099	23,816,707
22	Nasimshahr	1,649,326,174	1,113,576,487	37,463,146	9,603,744	0	11,107,711	214,385,099	263,189,987
23	Malard	1,372,749,530	742,384,324	37,463,146	19,207,489	44,547,367	8,330,783	214,385,099	306,431,321
	Total	118,413,328,662	67,556,973,516	2,135,399,310	499,394,708	22,006,399,407	697,008,847	13,506,261,257	12,011,891,617

Table 5. Cost of one cubic meter of regional gas in ABC

Row	Regions	Cost of One Cubic Gas (4)/(5)	Cubic Gas (5)	Total cost (4)=(1)+(2)+(3)	Consuming Gas (3)	Indirect Overheads (2)	Direct Overheads (1)
1	Eslamshahr	126.03	242,600,000	30,575,629,949	11,359,939,170	8,242,049,347	10,973,641,432
2	Pakdasht	59.05	340,070,000	20,079,449,391	1,269,392,461	11,745,367,432	7,064,689,498
3	Pishva	140.36	64,900,000	9,109,260,698	2,990,935,777	3,991,557,873	2,126,767,048
4	Damavand	54.52	1,300,250,000	70,885,656,290	62,514,770,316	2,532,943,923	5,837,942,052
5	Robat karim	195.71	43,100,000	8,435,221,428	1,982,723,623	3,234,874,982	3,217,622,823
6	Gharchak	109.11	148,800,000	16,235,934,548	7,105,227,713	4,819,327,433	4,311,379,402
7	Vavan	107.55	32,300,000	3,473,980,186	1,685,034,240	783,808,021	1,005,137,925
8	Varamin	391.65	78,750,000	30,842,585,489	9,969,785,922	10,814,242,910	10,058,556,657
9	Eshtehard	190.87	24,100,000	4,599,962,864	1,140,206,503	2,493,669,073	966,087,288
10	Shahregods	97.91	166,060,000	16,258,636,287	7,975,828,737	4,076,828,473	4,205,979,077
11	Shahriyar	136.14	170,430,000	23,202,201,304	7,863,493,121	7,433,833,655	7,904,874,527
12	Fardis	40.5	324,200,000	13,130,000,990	3,510,488,001	5,550,306,883	4,069,206,106
13	Karaj	113.26	1,760,260,000	199,360,839,332	135,364,417,305	28,735,072,635	35,261,349,391
14	Nazarabad	104.95	160,700,000	16,864,840,648	7,807,325,313	4,846,620,943	4,210,894,392
15	Vardavard	333.20	10,600,000	3,531,945,656	454,959,245	2,198,714,507	878,271,904
16	Hashtgerd	179.07	64,940,000	11,628,952,551	3,044,295,194	4,423,988,286	4,160,669,071
17	Bagherabad	26.48	101,110,000	2,677,778,506	1,291,859,584	749,435,505	636,483,417
18	Gheyamdasht	73.32	32,100,000	2,353,653,462	449,342,464	1,189,369,406	714,941,592
19	Chahrdange	92.05	106,800,000	9,830,519,194	5,111,270,529	4,363,706,902	355,541,763
20	Rodehen	166.06	22,430,000	3,724,781,999	645,929,792	1,694,872,895	1,383,979,312
21	Golestan	14.20	311,200,000	4,418,423,228	2,134,376,704	1,470,661,874	813,384,650
22	Nasimshahr	27.76	165,400,000	4,591,924,905	1,460,363,008	1,649,326,174	1,482,235,723
23	Malard	18.06	343,900,000	6,211,814,844	3,707,075,329	1,372,749,530	1,131,989,986
	Total	85.12	6,015,000,000	512,023,993,750	280,839,040,052	118,413,328,662	112,771,625,036

Table 7. Iranian Gas Company cost model

	Activities	Cost of activities
80% indirect overhead	Sustaining	67,556,973,516
	Main subscribers	22,063,999,407
20% indirect overhead	Transportation	13,506,261,257
	Engineering	12,011,891,617
	Computer	2,135,399,310
	Telecommunication	697,008,847
	Measuring &distribution of gas	499,394,708
	Total	118,413,328,662

Table 6. Comparing cost of one cub meter of gas in ABC and TCSs

Row	Regions	Cost of One Cub Meter of Gas in TCS (Single Method)	Cost of One Cub Meter of Gas TCS (Multiple Method)	Cost of One Cub Meter of Gas in ABC System
1	Eslamshahr	74.2	110.98	126.03
2	Pakdasht	74.2	29.95	59.05
3	Pishva	74.2	101.13	140.36
4	Damavand	74.2	53.46	54.52
5	Robat karim	74.2	157.31	195.71
6	Gharchak	74.2	89.87	109.11
7	Vavan	74.2	102.00	107.55
8	Varamin	74.2	310.60	391.65
9	Eshtehard	74.2	109.31	190.87
10	Shahregods	74.2	91.33	97.91
11	Shahriyar	74.2	104.53	136.14
12	Fardis	74.2	32.86	40.5
13	Karaj	74.2	105.04	113.26
14	Nazarabad	74.2	86.66	104.95
15	Vardavard	74.2	176.74	333.20
16	Hashtgerd	74.2	136.04	179.07
17	Bagherabad	74.2	25.61	26.48
18	Gheyamdasht	74.2	45.04	73.32
19	Chahrdange	74.2	58.24	92.05
20	Rodehen	74.2	114.28	166.06
21	Golestan	74.2	16.22	14.20
22	Nasimshahr	74.2	27.42	27.76
23	Malard	74.2	20.82	18.06

Table 8. The analysis of the allocation of the indirect overhead to regions

Row	Regions	Indirect Overhead	
1	Karaj	28,735,072,635	80% Indirect Overhead
2	Pakdasht	11,745,367,432	
3	Varamin	10,814,242,910	
4	Eslamshar	8,242,049,347	
5	Shahriyar	7,433,833,655	
6	Fardis	5,550,306,883	
7	Nazaabad	4,846,620,943	
8	Gharchak	4,819,327,433	
9	Hashtgerd	4,423,988,286	
10	Chahardange	4,363,706,902	
11	Shahregids	4,076,828,473	
12	Pishva	3,991,557,873	
13	Robatkarim	3,234,874,982	
14	Damavand	2,532,943,923	20% Indirect Overhead
15	Eshtehard	2,493,669,073	
16	Vardavard	2,198,714,507	
17	Rodehen	1,694,872,895	
18	Nasimshahr	1,649,326,174	
19	Golestan	1,470,661,874	
20	Malard	1,372,749,530	
21	Ghiyamdasht	1,189,369,406	
22	Vavan	783,808,021	
23	Bagherabad	749,435,505	
	Sum	118,413,328,662	

Table 9. Analysis of allocating the cost of main subscribers and sustaining

70% cost of main subscribers activity

60% cost of sustaining activity

Regions	Indirect Overhead (Main Subscribers)	Indirect Overhead (Sustaining)	Regions
Sakdasht	8,553,094,506	19,301,992,433	Karaj
Chahrdange	3,073,768,338	7,795,035,406	Pakdasht
Karaj	2,628,294,666	5,939,074,595	Varamin
Gharchak	2,494,652,564	5,196,690,270	Eslamshahr
Nazarabad	890,947,344	3,340,729,460	Shahriyar
Eshtehard	846,399,977	2,969,537,297	Fardis
Shahgods	668,210,508	2,969,537,297	Nazarabad
Varamin	623,663,141	2,598,345,135	Gharchak
Eslamshahr	445,473,672	2,227,152,973	Hashtgerd
Fardis	400,926,305	2,227,152,973	Chahardange
Pishva	356,378,938	1,484,768,649	Shahrgods
Robatkarim	178,189,469	1,484,768,649	Pishva
Varavard	178,189,469	1,484,768,649	Robatkarim
Shahriyar	133,642,102	1,484,768,649	Damavad
Hashtgerd	133,642,102	1,113,576,487	Eshtehard
Damavand	89,094,734	1,113,576,487	Vardavard
Rodehen	89,094,734	1,113,576,487	Rodehen
Vavan	44,547,367	1,113,576,487	Nasimshahr
Bagherabad	44,547,367	742,384,324	Golestan
Gheyamdasht	44,547,367	742,384,324	Malard
Golestan	44,547,367	371,192,162	Gheyamdasht
Malard	44,547,367	371,192,162	Vavan
Nasimshahr	0	371,192,162	Bagherabad
Sum	22,006,399,407	67,556,973,516	Sum

Table10. Direct overhead cost of regions

60% Direct Overhead

40% Direct Overhead

Region	Direct Overhead
Karaj	35,261,349,391
Eslamshahr	10,973,641,432
Varamin	10,058,556,657
Shahriyar	7,904,874,527
Pakdasht	7,064,689,498
Damavand	5,837,942,052
Gharchak	4,311,379,402
Nazarabad	4,210,894,392
Shahrgods	4,205,979,077
Hashtgerd	4,160,669,071
Fardis	4,069,206,106
Robatkarim	3,217,622,823
Pishva	2,126,767,048
Nasimshahr	1,482,235,723
Rodehen	1,383,979,312
Malard	1,131,989,986
Vavan	1,005,137,925
Eshtehard	966,087,288
Vardavrd	878,271,904
Golestan	813,384,650
Gheyamdasht	714,941,592
Bagherabad	636,483,417
Chahrdange	355,541,763
Sum	112,771,625,036

Table11. Cost of one cubic meter gas (COCMG) in regions

Regions	(COCMG)
Varamin	391.65
Vardavrd	333.20
Robatkarim	195.71
Eshtehard	190.87
Hashtgerd	179.07
Rodehen	166.06
Pishva	140.36
Shahriyar	136.14
Eslamshahr	126.03
Karaj	113.26
Gharchak	109.11
Vavan	107.55
Nazarabad	104.95
Sharegods	97.91
Chahrdange	92.05
Gheyamdasht	73.32
Pakdasht	59.05
Damavand	54.52
Fardis	40.50
Nasimshahr	27.76
Bagherabad	26.48
Malard	18.06
Golestan	14.20
Mean	85.12

Stage 6: Determining the relation between activities and Activity–Product-Dependence Matrix (APDM): In this stage, the activities consumed by the regions are determined and APDM is formed.

Stage 7: Calculating and replacing allocation rate in APDM: Based on cost drivers determined in stage 2 and applying calculation methods, allocation rates of activity expenses to product are calculated and placed in the APDM cells. Sum of the rates in each of columns of the matrix should be equal to one. To compute indirect overhead costs of regions, the following formula was appalled:

$$OCP(i) = \sum_{j=1}^{n} \{TCA(j) \times APD(ij)\} \quad (2)$$

Where *OCP(i), n, TCA (j)* , and *APD(i,j)* are indirect overhead costs of activity, number of activities, total costs of activity, and *i*the row and jthe column in APDM. After calculating amount of activity overheads for each region, the new APDM with monetary values was formed. Table 3 and 4 show the allocation rates and the monetary values of activity expenses to products.

Stage 8: Calculating cost of products/services: With allocating indirect overhead costs to the gas transferred regions in the APDM, cost of one cub meter of natural gas in those regions, direct overhead costs, and value of consumed raw materials of each region calculated by the following formula:

Cost of one cub meter = Region raw materials+ region direct overheads + region indirect overheads

Cub meters of consuming gas of the region

Table 5 shows cost of one cubic meter of regional gas in ABC system and Table 6 compares cost of one cub meter of gas in ABC and two traditional costing systems. As shows in table 6, there are significant differences among the cost of one cubic meter of gas under three method of calculation. One of the reasons why the amounts of cost of one cubic meter of gas in these two methods are different is that in TCS, some costs are considered in calculating cost of products, but in ABC, all the costs traceable to product are considered in calculating cost. Another reason is the method of tracing indirect costs to products. In the TCS, product consumes organizational resources but in ABC, activities consume organizational resources are traced to products based on drivers related to each activity.

Results of Data Analysis

Table 7 shows Iranian Gas Company cost model. As it is seen, eighty percent of the Tehran Gas Company resources is used by sustaining activity and main subscribers and the remaining 20 percent is consumed by other activities. In the cost model of Tehran Gas Company, 75% of 80% consuming resources was used by sustaining activities. This means that the managers of Tehran Gas Company should pay attention to this cost center to control and decrease the costs.

Table 8 analyzes the allocation of the indirect overheads to different regions. In Table 8, the amounts of indirect overheads of regions in ABC have been ordered descending. As it is clear, 80% of the total indirect overheads are dedicated to Karaj, Pakdasht, Shahriyar, Fardis, Nazarabad, Gharchak, Hashtgerd, Chahardange and Shaegods. As shows, Karaj city has the highest share of indirect overheads.

Table 9 analyzes allocating the cost of main subscribers and sustaining. As it is clear in Table 9, sixty percent of the total costs of sustaining activity, which has the highest cost in Tehran Gas Company cost model, are placed in Karaj, Pakdasht, Varamin, Eslamshahr and Shahriyar. Seventy percent of total cost of main subscribers' activity, which is in the second row of table 7, is placed in Pakdasht, Chahardange, Karaj and Gharchak. Because sustaining activity consist of 75% of the total cost of sustaining and main subscribers, the management of Tehran Gas Company should pay attention to this critical region; in this manner it can control almost 50 percent of the company costs.

Table10 shows direct overhead costs of regions. In Table 10, the amounts of direct overhead costs of regions are ordered descending. As it is indicated in the Table, 60% of the total direct overheads are placed in Karaj, Eslamshahr, Varamin, Shahriyar and Pakdasht, As seen in table 10, fifty percent of the direct overhead is consumed in Karaj city. Since these cities have most of the share of Tehran Gas Company budget, the management of the company should pay more attention to the resources allocated to these regions and their performances in relation to budget consumption. The management of Tehran Gas Company with using activity based budgeting can make useful decisions about correct budgeting and decreasing costs and use it as a means for evaluating performances of different regions.

Finally, Table11 shows cost of one cubic meter gas in regions. As shown in Table 11, cost of one cubic meter of the regional gas was ordered descending. In other words, different regions have different costs and in some cases have many differences, while all the subscribers in different regions pay the same price for the consuming gas.

Conclusions and Final Remarks

Traditional single overhead rate method is not concerned with the actual relation between the expenses and their cause of existence because it just makes use of one based in sharing out factory overhead. This method due to the average out to the high and low amount of the overhead costs will result in product cost deviation. Generally, the multi rate method, through the creation of the cost centers based on the similar expenses or cost centers; allocate the expenses in these centers to the products/services based on the one of the determined basis. In this system, there is no relation between the necessary activities for producing product or giving services and use of financial resources by these activities. Accordingly, cost of products/services does not show the company activities and the value of the resources used by the company.

In the ABC, this fault removed by the direct arranging of the organizational costs and operational activities. Pragmatically, the ABC determines the causal relations between the creation of expenses and the necessary activities for producing product or giving services, which have the economical value for the company. Instead of one factor, several basis factors determine the activities, the cost center for each activity, find the rates related to expenses and attract these rates to the products based on the resources which are used for producing product or giving services. Therefore, we can say that in the ABC with the more appropriate allocation of the collected expenses in cost centers to given services, these services are costed more exactly. By improving the quality of the information, ABC system can inform the management about the activities, which consume company resources. This helps the manager to decide about the process which improve the quality of the activities done (process improvement) and the process which increase the result of those activities (productivity). Generally, the ABC system helps the manager in correct pricing of services and accomplishment of the strategic goals of the

organization by giving correct information about the cost of services.

This paper aimed to calculate cost of one cubic meter gas in different region of Tehran Gas Company using ABC. In this research, we explained the steps and the benefits of implementing ABC in Iranian Gas Company. Using ABC, cost of one cub meter of consuming gas in all regions of province of Tehran was determined and compared with the results of the TCS. The results show significant differences between ranges of cost deviations in the TCM in the highest and lowest levels. Benefits of implementing ABC strongly changed Iranian Gas Company managers' prospective toward company cost of services. It provided a very effective system for company internal decision-making, improved the effectiveness of the costing system and cost management, and helped the managers to correct pricing of services and accomplishment of the strategic goals of the organization by giving correct information about the cost of services. As a result, we can claim that the information collected from the ABC, comparing with the present TCS of Tehran Gas Company, was more useful and valuable for the Iranian managers' decision-making.

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