

## Modeling the Factors Affecting the Use of Environmental Management Accounting Tools

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### ABSTRACT

The present study examines and models factors influencing the use of environmental management accounting tools from the financial managers and their assistants' point of view in the Iranian oil refineries and petrochemical companies. For the purpose of the study, five hypotheses were developed and tested using the models of structural equations. The required data were also collected by a questionnaire. According to the financial managers and based on their assistants' point of view, limited resources and lack of financial support, specialist human resources, knowledge, support of management, the complexity of the tools, and the ability to create comparative advantages are the factors affecting the use of environmental management accounting tools. The findings of the fifth hypothesis also show that except sex, all of the personal characteristics of financial managers and financial managers' assistants, such as professional experience, field of study, academic qualification, and age have a significant impact on some effective factors in using the environmental management accounting tools.

**Keywords:** environmental management accounting, oil refinery and petrochemical companies, structural equation models.

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## **Introduction**

The business environment is growing and changing continuously. Ahadiat (2008) claimed that this growth is because of globalization, development of information technology, new rules on corporate governance, and competitions. These changes have had a significant impact on the role of management accounting (Bahramfar, Khajavi and Nazemi, 2007). What we should care about is that the new situation requires new methods in accordance with such inevitable changes and developments. Therefore, any management accounting system is expected to adapt to the new situation and, if possible, to go beyond the current situation (Albright & Lam, 2006).

One of the issues raised recently in the field of management accounting is environmental management accounting. In the past, the environmental issues were not introduced in the economic discussions. Pressures on organizations in order to quantify the environmental damages and conduct cost management were not evident. Now, the situation has changed. Companies' environmental performance has attracted the special attention of internal and external stakeholders and brought a major challenge and concern to the accounting. Because of social concerns about the environment, organizations are forced by the fact that they have no inherent right to the environment and should be responsible for the environmental consequences. This study seeks to identify and propose a model for the factors influencing the use of environmental management accounting tools in Iranian oil refinery and petrochemical companies.

## **Theoretical Background**

In This section, we review the factors influencing the use of environmental management accounting tools:

### **Limited Resources and Lack of Financial Support**

Financing in innovative activities within a timely, adequate, and appropriate framework is very important. Indeed, the formation of any innovative action needs to provide adequate financial resources to guarantee its survival and activity. Appropriate financing, facilitation payments, mobilization, and allocation of resources and coverage uncertainty could facilitate innovation in firms. Financial pressure is one of the serious obstacles to the promotion of innovative activities in companies. The development of innovation as one of the most important engines of an economic growth relies heavily on financing. Amirnejad and Rafiee (2011)

concluded that there is a positive relationship between earnings and willingness to pay for environmental protection. If income support is suitable, then the industry's is more willing to pay for the environmental protection.

#### **Specialist Human Resources**

Knowledge including skills, awareness, and confidence is needed for the successful implementation of innovative applications. The knowledge of employees is not only required for accepting innovation, but also accelerates the adoption and implementation of an effective innovation in organizations. Sears's study in 1985 showed that there are four levels of change in an individual. One must first change his/her knowledge (education). This change in knowledge will change the attitude and a change of attitude leads to changes in individual behavior and individual behavior changes group behavior. Therefore, the most important variable for predicting human behavior is his/her knowledge about the environmental issues. Knowledge is necessary for successful activities. Although knowledge does not always affect the behavior, it reinforces other mechanisms that will facilitate the behavioral change (Vaghefi and Haghghiatiyan, 2014).

#### **Knowledge and Management Support**

Top management should initiate any changes in the organization. The authorities must be justified and acquire necessary environmental training, so that their performance leads to the injection of the spirit of environmental protection in the organization and creates an energetic movement in this area (Poorghasem and Khalaj, 2008). Senior management support is one of the most important factors that facilitates the adoption of new technologies in the organization and have a positive relationship with technology adoption (Wang et al., 2010). Many studies have shown that senior management played an important role in the adoption and diffusion of innovations in an organization (Premkumar and Roberts, 1999). Koh et al. (2006) also believed that improving IT facilities in public organizations is dependent on the support of senior management. Their tendency to innovation plays an important role in the allocation of resources to do so. Thus, senior managers should be risk takers and take the risk of failure or delay in obtaining results. The willingness to pay for environmental protection will increase if the environmental knowledge of management is increased. Therefore, by giving the necessary training, managers and executives' level of awareness about the importance of environmental issues would be improved.

### **Complexity of the Tools and the Ability to Create Comparative Advantages**

The complexity is a criterion, which is related to the understanding and use of a type of technology, or an innovation that is relatively difficult. Usually there is an inverse relationship between the complexity and adoption of a new technology (Rogers, 1983). Since the complexity of a technology can be considered as a limiting factor in accepting new technology, it has a negative relationship with the adoption of new technology (Premkumar and Roberts, 1999). On the other hand, it is reasonable that organizations consider a comparative advantage of technology for their acceptance. Rogers (1983) defined the comparative advantage as the extent to which a new innovation supposed to be better and superior. Therefore, the use of environmental management accounting tools could add more competitive advantage to an organization and increase the efficiency and effectiveness of its decision-making process. Hence, companies that understand the advantages are more likely to accept it.

### **Literature Review**

Mokhtar, Jusoh and Zulkifli (2016) studied five features of companies, including industry sensitivity to the environmental issues, firm size, ownership structure, implementing environmental management, the percentage of outside directors, and its impact on the implementation of environmental management accounting. Their results showed that compared with the past, the use of environmental management accounting is increased. In addition, more emphasis was placed on cost-benefit considerations of environmental activities. They also found that the extent of implementation of environmental management accounting among different companies with different characteristics was not much different.

Ebrahimpour et al. (2015) noted that the implementation of environmental accounting is in the interests of all consumers, but Iranian organizations are not willing to this issue. More standards and procedures are needed to promote community's life and health.

Amiratashani, Moshdaei and Mahmoodzadeh (2014) studied and prioritized management accounting techniques by using questionnaires in 13 subsidiary companies of National Iranian Oil Refining and Distribution Company. The results of this study indicated that in three major companies, namely, the National Iranian Oil, National Iranian Gas, and National Iranian Oil Refining and Distribution Company cost management, economic value-added and cost management techniques were accounted for the highest score

in this study.

A study by Jamil et al. (2015) used an organizational theory and questionnaires to analyze factors affecting the implementation of environmental management accounting. Results indicated that the majority of organizations dedicated funds for environmental activities, but there are obstacles that need to be solved by the government and other legislative bodies.

Muza and Magadi (2014) found that the adoption of environmental management accounting will increase the sustainable development in companies and the country.

### **Research hypotheses**

Considering the research questions and theoretical foundation of this study, five hypotheses were proposed as follows:

**H<sub>1</sub>:** There is a relationship between the use of environmental management accounting tools, limited resources and lack of financial support.

**H<sub>2</sub>:** There is a relationship between the use of environmental management accounting tools and specialist human resources.

**H<sub>3</sub>:** There is a relationship between the use of environmental management accounting tools, knowledge and support of management.

**H<sub>4</sub>:** There is a relationship between the use of environmental management accounting tools, the complexity of the tools and the ability to create comparative advantages.

**H<sub>5</sub>:** There is a relationship between administrators and financial assistants' point of view about the factors influencing the use of environmental management accounting tools and individual characteristics including gender, education level, field of study, professional work experience, and age.

### **Research Methodology**

The research method of this study is based on a descriptive survey and its design is quasi-experimental. As far as the theoretical part is concerned, the required data collected from books, journals, and websites. For the field study, a questionnaire including 5 general and 31 specific questions was used. To make sure of the validity of the questions, questions of the questionnaire were corrected for several times based on experts' opinions. As a result, the questionnaire is a valid one. To evaluate the reliability of the

questionnaire, Cronbach's Alpha and split-half tests were carried out. The observed coefficients were above 70% for all of questions, therefore, the questionnaire used in the study is reliable and none of the questions were removed.

The research population consists of financial managers, vice financial managers, and chief management accountants in oil refining and petrochemical companies, a subsidiary of the national oil company. No sample was selected and the whole population was studied. Therefore, 200 questionnaires sent to the members of the population directly. Among 200 questionnaires distributed, 160 questionnaires were returned and used in this study.

To analyze the data collected by questionnaires, descriptive and inferential statistical methods were used. After classifying and organizing the collected data, mean, median, mode, and standard deviation for each of the questions were calculated. In inferential statistics, one sample t test, Pearson correlation, confirmatory factor analysis, path analysis, structural equation modeling, two sample T test and analysis of variance were conducted.

## Hypotheses Testing

### One Sample T-Test

One sample T-test was conducted in this section, Due to the adoption of the 5-point Likert-type questions, an average of 1 to 5 (number 3) was taken as the mean for the test. The 95% significance level was used for all variables to reject the null. Results showed that the mean of research variables has a significant difference, which means that all variables are in good condition.

**Table 1. One sample T-test result of 1-4 hypotheses**

Hypotheses	T Statistic	Degree of Freedom	Significance Level	=3	95% Confidence Interval For Mean Difference	
				Mean Difference	Upper Bound	Lower Bound
					1	24.02
2	27.69	159	0.000	1.28	1.377	1.194
3	14..17	159	0.000	0.671	0.765	0.577
4	18.28	159	0.000	1.05	1.171	0.942

**Pearson Correlation Test**

Before the model of structural equations being examined, the correlation between the variables was tested. Table 2 shows significant levels and correlation coefficients of each variable. Correlation coefficients for all variables of the test are higher than 0.05 and significant level is close to 0.0001. All correlations between the variables are significant.

**Table 2. Pearson correlation test result**

	<b>Correlation Coefficient</b>	<b>limited resources and lack of financial support</b>	<b>specialist human resources</b>	<b>knowledge and support of management</b>	<b>complexity of the tools and the ability to create comparative advantages</b>
	<b>Significant Level</b>				
limited resources and lack of financial support	Correlation Coefficient				
	Significant Level				
specialist human resources	Correlation Coefficient	0.757			
	Significant Level	0.000			
knowledge and support of management	Correlation Coefficient	0.780	0.671		
	Significant Level	0.000	0.000		
complexity of the tools and the ability to create comparative advantages	Correlation Coefficient	0.709	0.636	0.776	
	Significant Level	0.000	0.000	0.000	

**Confirmatory Factor Analysis**

In order to assess and confirm that each variable measuring a relevant hypothesis, confirmatory factor analysis was used. Table 3 shows the standard coefficient, explained variance, and a significant level of each research hypothesis. The results indicate that all statements intended to test hypotheses, according to standard coefficient measures, have a necessary correlation. Moreover, t-statistic is used to determine the significance of the model coefficients. Since the significance level for all statements is higher

than 1.96, it can be said that all statements are effective.

**Table 3. Confirmatory factor analysis test result**

Hypotheses	Mean	SD	Standard Coefficient	Explained Variance	T Value
1	4.33	0.78	0.28	0.47	3.94
2	3.82	0.81	0.43	0.42	-7.36
3	4.05	0.89	0.60	0.49	5.80
4	4.22	0.72	0.32	0.52	4.63

In addition, the values of the fitting parameters in Table 4 show that the model goodness of fit is in a great position and all parameters are fitted to a high explanatory power.

**Table 4. Goodness of fit test result**

Goodness of Fit Index	Significant Level	Model Statistic
(Chi square) $\chi^2$	$\chi^2/df \leq 3$	1.7
RMSEA	RMSEA<0.08	0.080
NFI	NFI>0.90	0.90
CFI	CFI>0.90	0.91
GFI	GFI>0.90	0.90
AGFI	AGFI>0.85	0.86
IFI	IFI>0.9	0.91

#### Path Analysis

In this section, the proposed hypotheses are tested by the Path analysis. The output diagrams show the significance level of the coefficients and parameters of the test. The significance level should be more than 1.96 or less than -1.96. The results and significance levels of the Path analysis are shown in figures 1 and 2 below.

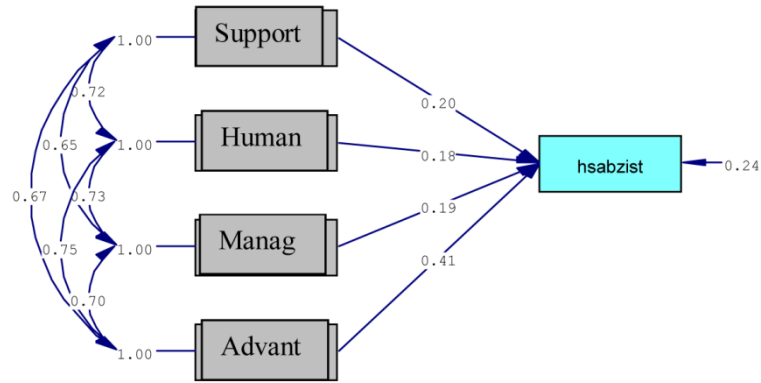
The result indicates that among investigated factors, the complexity of tools and the ability to create comparative advantage has the greatest impact among the factors influencing the use of environmental management accounting tools. After that, limited resources and lack of financial support, knowledge, support of management, and the specialist human resources have the greatest impact.

#### Structural Equation Model Analysis

The structural equation model was used to test the conceptual model and hypotheses. Figure 3 presents the standardized coefficients that represent

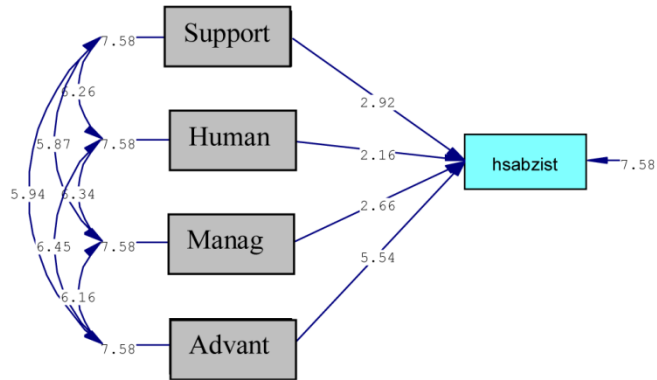


the impact of each factor in explaining the variance factors. According to Figure 4, all the t-statistic values are more than 1.96; the conclusion is that all the routes specified in the model are significant. In other words, the four factors under investigation affected the use of environmental management accounting tools in oil refining and petrochemical companies. The goodness of fit test results also shows that in this study, structural equation model is in a great position .



Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

Figure 1. Diagram based on the analysis of standardized coefficients



Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

Figure 2. Diagram of the factor loading

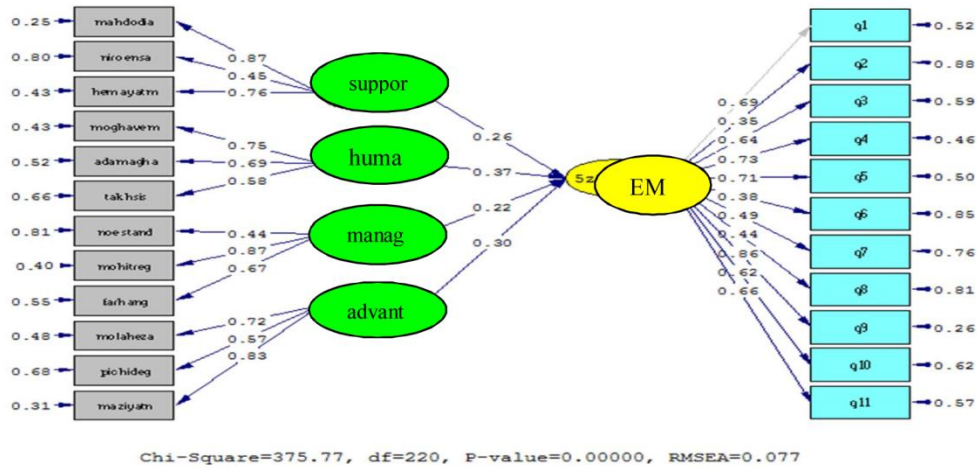


Figure 3. The standard estimate is based on a conceptual model.

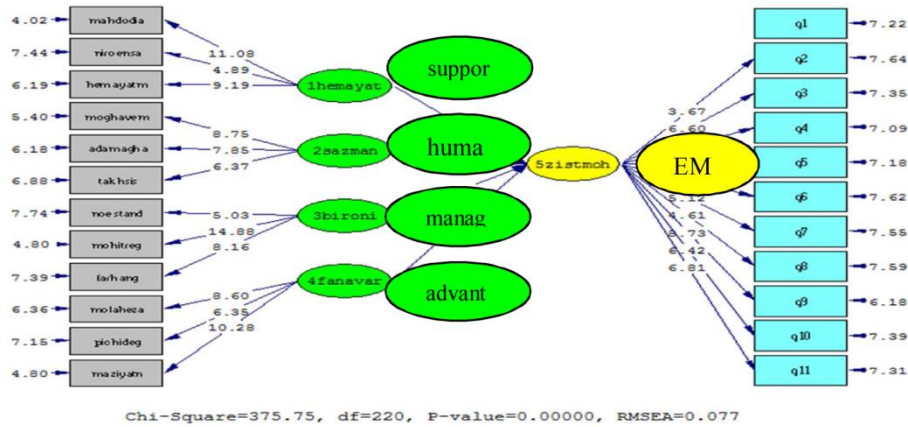


Figure 4. Diagram of significant numbers of conceptual model

Two-sample T-tests and variance analysis were used to test the fifth hypothesis. Table 5 shows a summary of the result of the test. Gender seems to have no effect on financial managers' view as far as the research hypotheses are concerned. Age, however, is effective as far as hypotheses 2, 3 and 4 are concerned. Education level, except for the first hypothesis, does not seem to have a significant effect on financial managers' view. Professional work experience too, for all hypotheses can affect manager's view. Field of study, except for the fourth hypothesis, can affect financial managers' view.

Table 5. Result of the fifth hypothesis

	Hypotheses	1	2	3	4
Gender	T statistics	0.608	0.489	0.514	1.89
	Significant Level	0.544	0.626	0.608	0.059
	Result	H <sub>0</sub> not Rejected	H <sub>0</sub> not Rejected	H <sub>0</sub> not Rejected	H <sub>0</sub> not Rejected
Age	F statistics	1.94	3.23	3.32	4.61
	Significant Level	0.123	0.023	0.020	0.004
	Result	H <sub>0</sub> not Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected
Education Level	F statistics	5.9	0.92	1.81	2.07
	Significant Level	0.003	0.39	0.16	0.13
	Result	H <sub>0</sub> Rejected	H <sub>0</sub> not Rejected	H <sub>0</sub> not Rejected	H <sub>0</sub> not Rejected
Professional Work Experience	F statistics	9.2	5.56	6.2	4.24
	Significant Level	0.000	0.000	0.000	0.000
	Result	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected
Field of Study	F statistics	10.75	6.41	6.16	1.99
	Significant Level	0.000	0.000	0.000	0.116
	Result	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> Rejected	H <sub>0</sub> not Rejected

## Conclusion

The results of hypothesis testing indicated that null-hypotheses are rejected and all of four hypotheses are accepted. That is, the observed result indicates that financial managers in petrochemical and oil refining companies believe that limited resources and lack of financial support, specialist human resources, knowledge, support of management, the complexity of the tools, and the ability to create comparative advantages affect the use of environmental management accounting tools. Path analysis and structural equation modeling analysis showed that among the effective factors, the complexity of the tools and the ability to create comparative advantages has the highest effect.

The analysis of personal characteristics reveals at 95% confidence level, gender is not a significantly effective factor, as it does not affect the research hypotheses. As for the second, third, and fourth hypotheses, age is

found to be an effective factor by creating a significant difference. This may be because of the increasing experience in professional work, because of aging. Education level, except for the first hypothesis, did not have any special effect on other hypotheses. Professional job experience had an effect on all hypotheses. Field of study too, except for the fourth hypothesis, has an impact on the other hypotheses.

According to the results that confirmed the effect of knowledge and support of management, the implementation of environmental management accounting requires serious knowledge and support of managers and their direct participation. Therefore, it is recommended to provide the necessary measures for culture and the media in order to support the success implementation of environmental management accounting and to affect the rest of the group, reach a consensus, and avoid the projection. Moreover, due to the impact of human capital in the implementation of environmental management accounting, seminars and training courses is recommended to familiarize those involved in the implementation of environmental management accounting with the usefulness of this achievement and reduce their complexity.

It is recommended to future researchers to identify different patterns of innovative adoption study and develop other factors. Moreover, the role of individual variables, environment variables, and log position was examined with regard to the vital impact of these independent variables in this model in order to improve or offer new models to examine patterns.

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