THE CHOICE EXPERIMENT TECHNIQUE ASSESSMENT ON VALUATION OF SUSTAINABLE MINING SOCIAL IMPACTS

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Abstract: Job creation is one of the important social impacts of mining, which can be considered covering many aspects. The number of new jobs created, the duration of employment, the acquisition of skills for employment in other mines, and the duration of work in inappropriate conditions (especially underground mines) can be attributed to the job creation opportunities created by mining in the region. In addition to the points mentioned above, mining has some positive social impacts, such as creating welfare facilities and improving the livelihoods of the people in the region, and aslo some negative impacts, for instance, the creation of social anomalies, or gender imbalance. So far, many researches has focused on the economic and environmental impacts of mining, but the third criterion of sustainable development, which is the community, has been neglected. In this paper, "choice experiment" method, a new method of the "stated preferences" approach, has been used to estimate the values of mining social impacts. In this study, the social impacts of mining have been investigated in two categories; employment, and other social impacts of mining. A questionnaire was prepared and the results of 780 responses for each section were used as input for STATA software after encoding and its appropriate pattern and respondents preferences according to the coefficients and pattern results. Based on the results of estimating conditional logit in the categories, Lagrange's ratio proved to be statistically significant, which shows a significant regression for the model. Also, according to the results, it can be said that for respondents, the number of jobs and desirability of the livelihood is of the greatest value, and they are willing to work longer in inappropriate conditions, provided that these conditions do not lead to social anomalies in their place of residence.

Keywords: mining, sustainable development, choice experiment, conditional logit.

1- INTRODUCTION

Sustainable development refers to a development system, which provides the current needs of the community, and the ability to meet the needs of future generations. The sustainable development in mining came up in early 1990's. Sustainable development has three main pillars, including economics, society, and the environment. In recent years, several studies have focused on the sustainable development in mining. Many mining and sustainable development researches have been based on two principles of economics and the environment, while limited researches paid attention to the community principle. In one of the most recent studies, all researches on mining and the social development index of sustainable development have been reviewed. No researches have focused on quantifying these indices. Many services, including the services and impacts of mining, cannot be traded on the market, and are not affiliated with, or related to any market. Therefore, people cannot express what they are willing to pay for it. In this context, people are asked to express directly what they are willing to pay to get a service based on a hypothetical scenario. In recent decades, Stated Preference approaches, or hypothetical market-based approaches, have been developed, both theoretically and practically, in various fields such as marketing, environmental economy, transport, health economics, etc. The Stated Preferences include three conditional valuation methods, multiple property valuations, and a Delphi method. The preferred methods of reliance on data are those that directly ask respondents about their preferences, and the researcher tries to extract the value of the product or service by asking people about their preferences for it. The common feature of all these methods is the direct questioning of people about their possible choices in a hypothetical market. Finally, the willingness to pay (receive) the average respondent is calculated. In fact, the willingness to pay

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for a change in quality or the preparation of goods or services is measured, which is conditional in the questionnaire.

Considering the increasing importance of mining, it is vital to work on the development and the importance of mining social indicators, to address the social impacts of mining. On the other hand, the existence of different methods for valuing non-market goods provides an appropriate tool for evaluation of mining social impacts. Therefore, the present paper aims to evaluate the most important social impacts of mining using the choice experiment method, which is a subset of the valuation methods of multiple characteristics. In this study, the social impacts of mining are examined in two sections of job creation, and other issues. The topic of creating a job is measured by the characteristics of the number of the new jobs created, the duration of employment, the acquisition of skills for employment in other mines, and the duration of work in inappropriate conditions (sometimes underground mines). Other issues include positive social impacts, such as creating welfare facilities and improving the livelihoods of the people in the region, and negative impacts, including social malformations, and gender biases (due to labour migration in the society, males outnumber females) in the area where the mine is located.

2- METHODS

The choice experiment method, which was recently added to the set of preference methods, has been introduced and developed in 1982 and 1983. This technique is based on the theory of random utility and has become a common tool for environmental valuation. In the choice experiment method, respondents choose the preferred option among a number of options. Each option contains several attributes that are described by the corresponding levels (values corresponding to the attributes). Each feature can have several qualitative and slightly different levels. The main purpose of the choice experiment is to select the consumer preferences estimation with an emphasis on the relative importance of the features. To achieve this goal, one is asked to choose one out of several hypothetical options chosen in a series of choices, and the desirability of a particular hypothetical option is calculated by the individual's desirability of the levels of each property selected in the hypothetical option. To use the choice experiment method, 6 steps are required:

Step 1: Attributes associated with the desired product or service are specified and defined.

Step 2: Two or more levels for each attribute are determined.

Stage 3: Different combinations of attributes and their levels are formed, and a good number of these compounds are selected as the option by statistical methods.

Step 4: Each two or three options together form a series of choices.

Step 5: Choice series are put together in form of a questionnaire, to collect people's opinions.

Step 6: Results are estimated and analyzed.

3- FINDINGS AND ARGUMENT

The results of estimating the logit model indicate that except for the duration of work in inappropriate conditions and the price, the sign of other attributes is positive. Also, all attributes except the price are significant at 1% level. The coefficient of the price is negative because by increasing the price, the desirability of the option to be selected by individuals decreases. The

negative coefficient of the duration of work in unsuitable conditions also means that as the duration of employment in these conditions increases, , the probability the option being chosen by the respondent will be reduced. Regarding the negativity of the Hausman-McFaden test, the elimination of any of the three options in each selection set has no significant effect on the remaining parameters of the model, aslo the assumption of independence of the unrelated options for these models can not be ruled out, thus the validity of the results of this model is approved. The results of estimating the conditional logit model for other social impacts of mining determined that social anomalies and gender imbalances have a negative coefficient, indicating that the higher these two attributes, the lower the chance of the option being chosen.. Also, all attributes except gender imbalance and price mean at 1%, but these two attributes are significant at 5%. Lower meaningfulness shows the lower importance of these two features in choosing options.

Regarding the negativity of the Hamsman-McFaden test, in each selection set, eliminating any of the three options has no significant effect on the remaining parameters of the model, and the assumption of the independence of the unrelated options for these models can not be ruled out, thus the validity of the results of this model is approved.

Regarding the amount of willingness to pay for respondents, it is possible to rank the values of considered mining social impacts in this study, from 1 to 8: number of jobs, desirability of livelihood, social maladaptation, skills acquisition, working time in inappropriate conditions, welfare facilities, the duration of employment, and the contraction of gender balance. In general, according to the results of this research, respondents prefer to pay more for creating more jobs, and increasing their livelihood utility, while they are not willing to create social anomalies in order to acquire new skills through mining in their area. They are also willing to work longer in unsuitable conditions, to create welfare facilities in the region, and to prolong their employment opportunities.

4- CONCLUSIONS

The choice experiment method, as one of the selection modelling methods, is expressed in the family of preferences and the hypothesized market that has been expanded in recent decades. The application of this method has shown that it has great potentials in various fields such as economics of environment, transport economy, urban economy, marketing, estimation of farmer preferences in insurance issues, and in general, any field that needs to estimate the preferences of individuals to form the demand, and extract utility and cost functions. The advantages of the choice experiment method are the ability to calculate the value of non-market functions and the ability to consider socio-economic variables in selection modelling methods. In this study, the choice experiment method was used to evaluate the social functions of mining. After estimating the conditional logit model, the willingness to pay for the characteristics was calculated. The results of model estimation and related statistical tests showed a significant overall regression of the model, which indicates the efficiency and appropriateness of this method for the social criteria of mining. The results of the willingness to pay individuals show that such information can be used for management decisions, so this method can be used as a tool to support decision makers in the field of mining and related social and environmental issues. Addressing the issue of valuing social functions of mining using the choice experiment method is the main difference between the present study and other Iranian studies. The fact demonstrates the importance and necessity of such studies, and on the other hand, it shows that there are no similar studies carried out in the country. Therefore, it is suggested to focus more studies on this field to eliminate the

shortcomings of this new approach with practice, and to improve the possibility of further applications of the method in mining.

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