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Negative impacts of mine exploitations on rural regions of Tekab Township

G. Mojarradi*, R. Rezaei and A. Ketabi

Department of Agricultural Extension, Communication and Rural Development, University of Zanjan, Zanjan, Iran

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**Corresponding author: gmojaradi@yahoo.com (G. Mojarradi).*

Abstract

This descriptive analytical survey was aimed to study the negative impacts of mine exploitations carried out in the rural regions of the Tekab Township located in Iran. The statistical population of the studied areas consisted of all the heads of the rural households in the villages located in the vicinity of the mines in the Tekab Township (N=2680). According to the Cochran formula, a sample size of 220 was selected using a stratified random sampling technique (n=220). A questionnaire was used to collect the data required. The validity of the questionnaire used was confirmed by a panel of experts. A pilot study was conducted to establish the reliability of the instrument used. The Cronbach's alpha coefficient for the main scale of the questionnaire including the negative effects of the mine exploitations was equal to 0.94. The results obtained from the factor analysis revealed that five factors including the environmental, social, economic, cultural, and hygiene factors explained 60.19% of the total variances of the negative impacts of the mine exploitations in the rural regions of the Tekab Township.

Keywords: *Descriptive Analytical Survey, Mine Exploitations, Negative Impacts, Tekab Township.*

1. Introduction

Rural development means the social and economic development of rural areas. In other words, a rural development is aimed to increase its economic opportunity, and to improve the quality of life in a rural mass. The negative consequences of development of rural areas such as the widespread poverty, increasing inequalities, rapid population growth, unemployment, and urban fringes are very important issues that have been mentioned by elites and rural development thinkers. Development processing in the developing countries has revealed this truth clearly because rural development is the foundation of the national development. Hence, rural development must be an important priority of national development programs [1]. The necessity of this priority and paying attention to the rural development compared to the urban development are because the final solution for urban unemployment and population density is improvement of the rural environments [2].

Due to the importance of rural development, these related programs were intentioned by policymakers and programmers in the late 20th century and early 21st century in many developed and developing countries. Thus they designed and implemented many different activities in order to improve the living conditions in the rural areas [3, 4]. They have emphasized on five basic dimensions of rural development namely natural resource managements, infrastructure and village physical developments, human resource management, agricultural development, and non-agricultural activity developments [5]. Development of non-agricultural activities can provide a desirable condition for the socio-economic and cultural developments [6] that have been emphasized by Liu (2007) [7] as the main components of the rural development programing.

The reduction in poverty and unemployment, and also increasing welfare and the supply of essential goods and services for the development of rural poor households need essential methods that have no urban bias, creation of employment and income in non-agricultural sectors, and, participatory, decision-making for industrialization of rural areas [8]. Although agricultural activities provide over 50% of rural household incomes, access to income from other activities such as mining and mine turret has an essential role in the rural people livelihoods [8-10].

The mine sector has a noticeable role in the supply of raw materials for different industries, so investment can lead to business value-added chains in many other economic sectors [11]. The impact of mine industry on wealth generation is low by itself but its impact on the secondary production sector and services as one of the mother industries is very significant [12].

Abundance of mineral reserves in some countries including Iran has a lot of potential for economy, so governments have accepted that mine industry and its development can play an axial role in the economic, social, and cultural development [13]. According to the geographical and local position of majority of the mines in rural areas, the exploration and exploitation of mines can affect the program of rural development in these regions, and put the positive and negative consequences for the local people in several villages [10, 14]. Mine exploitation has become a two-edged sword. On one hand, it has provided the necessary conditions for life and progress of rural areas, and, on the other hand, it has stripped the possibility of life and a healthy environment from local people because of the release of pollutants [15]. Despite the numerous benefits of mine exploitations in rural areas, we cannot ignore the local adverse impacts and undesirable consequences due to environmental changes because experience has shown that the problems related to operational planning, monitoring, and management of mines are more than their benefits in the long term [14].

Based on the results obtained from experimental studies, inappropriate exploitation of mines has numerous negative impacts and bad consequences such as degradation of agricultural lands because of embankment and excavation in mines; destruction of some of the valuable plant varieties; demolition and destruction of wildlife sanctuaries; destruction of privacy rivers; noise pollution caused by electrical devices and machinery activity in mines; creating dust; health threat to workers and residents around the mines; creation of very harmful wastes resulting from mine exploration; influence of waste on surface and underground water; contamination of water resources; and destruction of historic buildings and ancient monuments [9, 16-20]. Thus the growth and development of any country in a changing world depends on the amount of the country's people consciousness in their available resources optimally operated that must be based on necessary and accurate programming. Although the development and expansion of various industries in the rural areas, in particular, exploration, and mining are very useful purposes, no detailed evaluation and recognition of the positive impacts or negative consequences of such measures may lead to harmful consequences for rural areas [21].

Statement of problem: Tekab Township has high potentials in vision of mine sectors in the West-Azerbaijan province, Iran. In this area, there are very important mines such as gold mines, building stones, numerous metals, and industrial soils, 55 of which are active. A great majority of these mines are situated near the villages, and their activities face the rural settlements with harmful impacts, and so expansion of mine activities without an academic vision and accurate programming can cause the people living in this area facing with reduction of development trend and bad consequences in different dimensions such as the environmental, social, cultural, and economic ones [22].

To reduce the negative effects and to increase the positive impacts of mine exploitations at the level of Tekab Township villages in rural areas, academic studies should be undertaken so that these results can be used to find good strategies, and apply solutions for effective mining management [8]. Therefore, this research work was carried out to find the negative impacts of mine exploitations in the rural areas of Tekab Township.

Based on the research literature review, arrival of heavy metals like lead, mercury, and silver at an organism's body can cause oral and specific systemic disorders. Lead is one of the most common environmental toxins that create disease [23]. The harmful impacts of lead and zinc on the health of the workers and residents around mines have shown that 25.8% of these individuals are not entitled to public health, and are affected by various physical, psychological, and social conditions [24]. A wide spectrum of diseases is caused by arsenic and nearly all of its toxic compounds [25].

The research results obtained by Aminipour et al. (2008) [26] have shown that acute toxicity contacts with lead and zinc cause muscle weakness, numbness, pain, and illness. In some cases, patients face a hemistich attack and injury to the kidneys. Dust and free silica in open mines of lead and zinc cause workers' pulmonary injuries, and in some cases, cause diseases such as silicosis [27].

Majdi et al. (2009) [28] have investigated the occupational lung disease between the turquoise mine workers. They have found that the low but long-facing minerals, organic substances, and irritants in workplaces can face the workers and residents with slow and gradual diseases such as chronic bronchitis, asthma, and pneumoconiosis. In another research work, Gholipour et al. (2009) [29] have reviewed the environmental impact of acid mine drainage water in the coal washing plant tailings of Zirab in the Mazandaran province, and the results obtained showed that in dry seasons, water drained from the tailing warehouses polluted the surface and underground water because of the hydro-soluble sulfate evaporation. A study conducted by Iran Nejad, and Gharehbaghi (2010) [30] about the acidic mine drainage water, its environmental effects, and its neutralization strategies have indicated that drainage water acidity is the most important pollution; it is produced by mining activities and operations in coal mines and steel minerals, which leaves very dangerous effects in the environment, causes destruction of plant and animal species, and even the local people's life faces a great risk. Mining activities have negative effects on organisms such as environmental contamination of villagers and loss of geo-tourism in some areas having various animal and plant fossils [18]. In another research work, Soni et al. (2014) [31] have reviewed the environmental impact of Pit lakes as an end use of mining. Pit lakes have their values as resources for miscellaneous purposes e.g. recreation, fisheries, water supply, and wildlife habitat. Since pit lakes are best from the ecological restoration viewpoint, they are capable of compensating the damages caused due to mining, so this research result could be practically utilized for the evaluation and assessment of new project clearances and statuary compliance purposes.

Yeboah (2008) [32] has conducted a study on the environmental and health impacts of mining activities, and the results obtained have revealed that mine activities lead to the destruction and limitation of agricultural land for food production. In addition, water resource pollution, weather pollution, and sound pollution are some of the consequences of the mining activities, affecting the surrounding communities and their environments. These pollutions have provided the prevalence of various diseases, especially malaria and skin diseases among the local people. Chi and Pham (2009) [19] have carried out a research work on the negative effects of mining exploitation in rural environments of the Quang Ninh province in Vietnam, and the results of their work have revealed that mining activities and ground operations in this area have led to the loss of surface topography and waste flows, and their influence on the underground water has harmed agricultural lands in rural areas and has threatened local health in villages. They have also caused loss of forests due to the creation of open space for easy work and mining activities, and serious local social and cultural problems in the villages due to the unfairly distribution of exploiting benefits.

Twerefou (2009) [20] has investigated the relationship between mineral exploitation and its environmental sustainability. His research results have revealed that mismanagement of mining activities can impose negative impacts on the surrounding communities by vision of environmental and socio-economic dimensions. Narrei and Osanloo (2015) [33] have emphasized on the diversity of the environmental problems associated with iron ore mines e.g. removal of vegetation and top soil. The overburden/waste and ore bring about the inevitable natural consequences such as deforestation, climatic change, erosion, air and water pollution, and health hazards. Therefore, the responsibility of the mining industry is not just to exploit the ore and obtain income but also to plan for the best use of the resources available for mankind.

Musah (2009) [34] has assessed the sociological and ecological impacts of sand and gravel mining in east Gonja district (Ghana) and Gunnarsholt. The results of his study have revealed that the negative impacts of the sand and gravel mining activities consist of the loss of agricultural lands around the villages, prevalence of some dangerous diseases, increasing harmful insects, reduction of agricultural production yield, loss of bio-diversity, destruction of natural landscapes, conflict increase between local people, underground water pollution, contamination due to dust, and increase in poverty among local people.

Nazmul et al. (2010) [35] have found out that drinking water pollution by arsenic derived from the extraction of minerals can lead to a more risk of this substance, and cause disease in humans and animals. The research results have shown that about 1,200 people in Bangladesh have lost their lives due to the arsenic-contaminated drinking water. The results of the work carried out by Samadzadeh Yazdi et al. (2013) [25] have revealed that there are various species containing arsenic in wastewater of Mouteh Gold Plant, and that mining activities are among the main sources of the anthropogenic pollution of soil and water by arsenic.

2. Methods and materials

This descriptive analytical survey aimed to study the negative impacts of 55 active mines located in the surroundings of 33 villages in Tekab Township in Iran. The statistical population of the survey consisted of all the heads of rural households in the villages located near the Tekab Township mines (N = 2680, Table 1). Due to the geographical position of these villages, the rural residents in these regions are affected by mining exploitations in different dimensions. According to the Cochran formula, a sample of 220 persons was selected by the stratified random sampling method (Table 1).

Table 1. Profile of rural areas and their number of assigned samples.

No.	Village name	Number of households	Number of assigned samples	No.	Village name	Number of households	Number of assigned samples
1	Ilghon aghaj	192	17	18	Angorood	141	12
2	Bderlo	30	2	19	Golah golah	46	4
3	Ghale Jough	46	4	20	Zareh Shoran	69	6
4	Aoghol bayg	320	27	21	Shirmard	104	8
5	ASman balaaghi	25	2	22	Alocheloi sofla	94	7
6	Ay Ghaleh ci	30	2	23	Alocheloi Olia	20	2
7	Temay	112	9	24	Iaraziz	61	5
8	Durbash	231	19	25	Ahmdabadalia	96	8
9	Taskand	31	2	26	Maiin bolagh	77	6
10	Sari ghurkhan	30	2	27	Del Delbolaghi	24	2
11	Gharah Baba	6	1	28	Choblo	368	30
12	Gholdareh Sofla	48	4	29	Aghbolagh Hamadani	24	2
13	Beloz	30	2	30	Berenjeh	13	1
14	Gholdareh Olia	89	7	31	Gharah Bolagh	62	5
15	Aghdareh Sofla	25	2	32	Ghezel Gheshlagh	13	1
16	Aghdareh Olia	119	10	33	Gonbad	37	3
17	Aghdareh Vosta	67	5				
		Total population = 2680		**Total number of samples = 220**			

The data was collected from face-to-face interviews with the respondents based on a structured questionnaire. In general, the questionnaire consisted of two parts including the respondents' profiles and their viewpoints about the importance of each negative impact of mine exploitations (22 variables). The validity of the instrument was established by a panel of experts related to agricultural extension, communication, and rural development. In order to test the reliability of the questionnaire, its validated version was sent to 25 villagers who had not been selected as samples for the study. The Cronbach's alpha coefficient for the main scale of the questionnaire including the negative effects of mine exploitations was 0.94, indicating that the research questionnaire was reliable [36]. The collected data was analyzed using the statistical package for the social sciences (SPSS). In this research work, descriptive and inferential statistics were used to analyze the collected data. Descriptive statistics included frequency percentage, and mean and inferential statistics employed the technique of exploratory factor analysis (EFA). The main objective of this technique is to classify a large number of observed variables into a smaller number of factors (or latent variables) based on the relationships among the variables. The exploratory factor analysis is designed for the situations where the links between the observed and latent variables are unknown or uncertain. The analysis thus proceeds in an exploratory mode to determine how, and to what extent, the observed variables are linked to their underlying factors. Typically, the researcher wishes to identify the minimal number of factors that underlie (or account for) co-variation among the observed variables [37].

3. Results

As the results obtained show, the respondents' sex was 82.7% male and 17.3% female. The average age of the respondents was 34.43 years, ranging from 20 to 80 years. Table 2 shows the educational levels of the respondents; 27.3% of them had primary school degrees.

Table 2. Frequency distribution of respondents in terms of educational level.

Educational level	Frequency	Percent
Illiterate	20	9.1
Elementary	60	27.3
Secondary	58	26.4
Diploma	49	22.2
Higher than diploma	33	15
Total	220	100

The respondents' occupational status is presented in Table 3. According to the results obtained, a majority of the respondents' jobs (56.4%) was related to agriculture (including cultivation, animal keeping, and gardening), and 43.6% of them had other jobs.

Table 3. Frequency distribution of respondents in terms of occupational status.

Job	Frequency	Percent
Cultivation	62	28.2
Animal keeping	31	14.1
Gardening	31	14.1
Others	96	43.6
Total	220	100

The respondents had an average 13.26 of year experience by 1.5 SD in the agricultural activities. The frequency distribution of the villagers in terms of having/not having the direct activity in mines is presented in Table 4. The results obtained indicate that 78.6% of the respondents do not have any direct activity in mines.

Table 4. Frequency distribution of respondents in terms of direct activity in mines.

Direct activity in mine	Frequency	Percent
Yes	46	21.4
No	172	78.6
Total	218	100

As mentioned earlier, exploratory factor analysis was used to categorize the negative impacts of mine exploitations (including 22 variables), and to determine the amount of variances explained by each categorized factor. The Kaiser-Meyer-Olkin (KMO) measure and the Bartlett's test were used to determine the data suitability for the related analysis. The Bartlett's test was significant at the 0.01 level, and an appropriate amount of KMO (higher than 0.70) showed that the variables were suitable for the factor analysis (Table 5).

Table 5. KMO measure and Bartlett's Test to assess appropriateness of data for factor analysis.

KMO	Bartlett's test of sphericity	
	Approx. chi- square	Sig.
0.880	1112.608	0.000

The extracted factors are presented in Table 6 along with the eigenvalues, percentage of variance, and cumulative variance percentage. The criteria of previous value were used to extract and categorize the factors, of which, eigenvalues were bigger than one. The first factor alone with 3.872 eigenvalues explained 17.6% of the total variances, and, in general, the five extracted factors explained 60.19% of the total variances.

In addition to Table 6, the scree plot of the extracted factors is shown in Figure 1.

The variables with factor loadings greater than 0.5 were supposed in 5 factors after rotation by the Varimax method, as shown in Table 7.

Table 6. Number of extracted factors, eigenvalues, and variances explained by each factor.

Factors	Eigenvalues	Variance percent	Cumulative variance percent
1	3.872	17.601	17.601
2	2.676	12.164	29.765
3	2.541	11.548	41.313
4	2.284	10.381	51.694
5	1.669	8.495	60.189

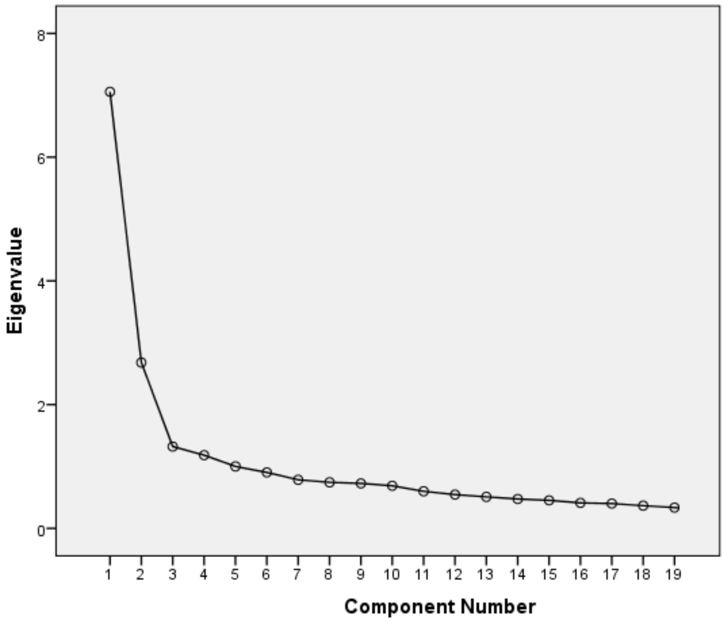

Figure 1. Scree plot of extracted factors.

Table 7. Variables loaded in five factors using Varimax rotated factor analysis.

Factors	Variables	Factor loading	Communalities
Environmental	Increase in environmental pollution such as weather and noise pollution	0.845	0.747
	Natural landscapes and environmental erosion of countryside	0.764	0.624
	Pollution of surface water and groundwater resources	0.741	0.626
	Loss of mineral springs and Qanats	0.681	0.547
	Land use change and reduction of farm and garden surface	0.600	0.618
	Ecological damage and wildlife population reduction in region	0.548	0.534
Social	Increase in conflicts and disputes between villagers	0.710	0.600
	Increasing willingness of villagers to use fancy goods and stairs	0.632	0.666
	Increasing crime and social aberrations in villages	0.577	0.497
	Negative changes such as clothing type, how to talk, and lifestyle of villagers	0.570	0.629
	Creation of income gaps between villagers	0.557	0.547
Economic	Increase in goods' price and services in rural areas	0.677	0.639
	Decreasing workforce in agricultural sector due to tendency of local people, especially the youth, to work in mines	0.665	0.523
	unusual increasing in the Land and housing price in rural areas	0.601	0.548
Cultural	Destroy of traditional architectural style because of modern housing expansion in rural areas	0.770	0.676
	Gradual reduction of local dialect spoken in villages due to arrival of outsiders	0.689	0.699
	Density Increase in villages' population due to temporary and permanent migration of citizens to villages	0.675	0.580
Health	Diffusion of new disease among local people due to pollution caused by mining activities and logging of outsiders to rural areas	0.703	0.648
	Increase in livestock and poultry diseases due to pollution of mining activities	0.584	0.622

4. Conclusions

The findings of this work showed that the development of mining activities and utilization of various mines had numerous negative impacts on the rural areas of Tekab Township. Based on the results obtained from the factor analysis, these impacts were categorized in five factors namely environmental, economic, cultural, social, and health. The factors explained 60.19% of variances of negative impacts of mine exploitations in rural areas of Tekab Township. The environmental impacts dedicated a considerable amount of variances by itself. This finding was confirmed by the finding of Dastorani et al. (2009) [17]; they have emphasized that mine activities have a serious impact on the environmental situation and pollution because it changes the natural balance of land, and leads to production of large amounts of solid and liquid substances in the form of tailings, condensing units and mineral processing, addition of slag, sludge, toxic waste, smoke and dust, and other contaminated and toxic fumes in the environment. The production of these harmful substances has led to the environmental pollutions such as soil, water resources, weather, and noise pollutions in rural areas. The region natural topography and rural around visions have been changed by the drilling and exploration operations. These activities and operations have led to destroy mineral springs and Qanats, decrease agricultural land for cultivation and gardening activities, and create more space for mining activities. In addition, we can focus on the loss of plant and animal diversity, and reduction in the wildlife population in many rural areas of Tekab Township as the direct impacts of mining activities in different stages of exploration, extraction, and preparation. The results of this part of the study were verified by numerous studies such as Gholipour et al. (2009) [29], Nekoei Sadri (2009) [18], Yeboah, (2008) [32], Chi and Pham (2009) [19], Twerefou (2009) [20], Musah (2009) [34], Samadzadeh Yazdi et al. (2013) [25], and Narrei and Osanloo (2015) [33].

The social factor was entered in the second stage of the factor analysis. The results obtained showed that only one fifth of the villagers were employed in the mines directly, however, 78.6% of them did not have any direct job in the Tekab mines. The income gap creation is one of the negative consequences of mining activities in this region because it has led to increasing conflicts and disputes, unfair distribution of the benefits among local villagers, and also centralization of the mining activity incomes in the hands of investors, government institutions, and some local elites. In addition, other consequences of mining activities in rural areas of Tekab Township can be listed as increase in villagers' income; entry of external and non-native people to villages; more relationship with outsiders and outside area of villages; road and way improvements; more access to the communication tools and equipment; negative changes in the rural behavior and lifestyles such as type of clothes, how to talk with each other, increase in luxury goods and tendency to use the stairs, rising crime, and social deviations. Thus due to the nature of these changes, we must expect more negative changes in the social dimension in the region if we do not have a proper planning and management. These results were verified by the results obtained by Twerefou (2009) [20] and Musah, (2009) [34].

In the third stage, the economic factor was entered in the factor analysis. Displacement of the agricultural workforce to the mining sector, and reduction of the agricultural labor are the most important negative economic impacts of mining activity developments in the rural areas of Tekab Township, which have arisen due to the local youth tendency to work in the mines. This issue can be a serious challenge for the agricultural human resources in the long term, and leads to a reduction in agronomy and horticultural products. The increase in price of goods and services, on one hand, and the increase in the price of agricultural land and also houses, on the other hand, can lead to social difficulties. This result was verified by the Twerefou (2009) [20] research results.

In addition to the environmental, social, and economic factors, we can refer to the other important factor of cultural impacts. Based on the findings in the cultural dimension, the negative impacts of mining activity development in rural regions of Tekab Township can be listed as the destruction of traditional architectural style of villages due to increase in the construction and modern urban duck, increase in the population density of the villages because of reverse migration, and gradual reduction of local dialect use because of the arrival of external persons to villages.

Health effects should also be mentioned as the last factor that can be covered among the negative impacts of mine exploitations in the rural areas of Tekab Township. The importance of this factor has been approved in the numerous research findings such as Tabrizi Zadeh et al. (2006) [23]; Halvaei et al. (2007) [24]; Aminipour et al. (2008) [26]; Samadi and Badri Sadat (2009) [27]; and Yeboah (2008) [32]. The drilling activities and exploitation of mines can produce a large amount of solid and liquid substances in the form of tailings, slag, sludge, toxic waste, smoke and dust, and other contaminated and toxic fumes in the environment. These harmful materials can pollute the surface water, groundwater, soil, and air, and can be a serious risk for the human and other organisms' health. The results of the studies carried out in Tekab Township show that mine activities and lack of appropriate control and planning has led to the prevalence of various diseases such as Silicosis (the exposure of workers to dust, resulting from the operation of the building and decorative stone quarries and mines' industrial soil), and also the prevalence of chronic diseases such as blood diseases, and abortions in villages near the gold mines for humans and various diseases of liver, hepatitis cyst, and abortion in mines' marginal pastures for livestock. Of course, the type of disease is differing based on the mining operation and area type. The creation of disease and its prevalence is due to the pollution of mineral activities, and in addition, it is the cause of external citizen people who enter the rural areas.

5. Suggestions

Based on the results obtained, the following suggestions are presented:

The mines are administrated by non-specialists, and they do not know the scientific and technical aspects of mine exploitations. Therefore, it is necessary that the agencies and the trustees set the rules and relevant laws, and use professional forces for mine management as much as possible.

In order to minimize the negative environmental impacts caused by soil erosion, it is recommended that during the drilling, sampling, chipping, road building, and other mining activities, the harvested soils storage away from the transfer lines of water sources.

The organizations in charge of these activities must monitor the mineral extraction activities seriously in order to maintain the plant and animal species.

In rebuilding the affected and operation areas, adopted plant and animal varieties in order must be used in renewing their environment.

Just some of the mines in use have treatment facilities, so filtration plants must be installed in mines to prevent entry of contaminated water flow from mines to rivers.

To reduce the noise pollution caused by mining activities, installation of sound barriers around the plants and using equipment with low noise or sound breathers is recommended.

The mining waste transports must be managed by identification and localizing region prone.

Boundaries of rivers, permanent springs, and rural drinking water sources must be considered on the construction of the new communication routes.

Seedling planting in margin road of mines, using petroleum products, and mulch throwing in dirt roads are recommended to avoid farm pollution.

For the survival of mine activities in rural areas, it is recommended that the technical issues such as environmental health, reducing waste and increasing efficiency of mining activities, and use of professionals and experts in different subjects be considered.

For a fair distribution of mine activities in rural areas, it is recommended that the local authorities have a direct monitoring on the local and indigenous employment in the mines.

To rebuild the mine areas, 12% of the mine exploitation income must be paid to the trustee devices in laws accordance. The pertinent organizations do not pay this money, so it is suggested that the local stakeholders monitor these costs.

The employers of the local mines are gradually fired; hence, in order to solve this problem, based on the employment law in public and private mines, it is suggested that a specific framework is set based on the country's employment policy.

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بررسی آثار منفی بهره‌برداری از معادن در مناطق روستایی شهرستان تکاب

غلامرضا مجردی*، روح اله رضایی و ایوب کتابی

گروه ترویج، ارتباطات و توسعه روستایی، دانشگاه زنجان، ایران

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*نویسنده مسئول مکاتبات: gmojaradi@yahoo.com

چکیده:

این پژوهش توصیفی- تحلیلی با هدف بررسی آثار منفی بهره‌برداری از معادن در مناطق روستایی شهرستان تکاب انجام شده است. جامعه آماری این تحقیق را ۲۶۸۰ نفر از سرپرستان خانوار ساکن در مناطق روستایی نزدیک به معادن در شهرستان تکاب تشکیل دادند که با استفاده از فرمول کوکران و روش نمونه‌گیری طبقه‌ای با انتساب متناسب ۲۲۰ نفر از آنان به‌عنوان نمونه آماری انتخاب شدند. ابزار گردآوری داده‌ها پرسشنامه بود که روایی آن با نظر پانلی از متخصصین، مورد تائید قرار گرفت. برای تعیین پایایی ابزار تحقیق نیز از روش پیش آزمون و آلفای کرونباخ استفاده شد که مقدار آلفا برای شاخص آثار منفی بهره‌برداری از معادن ۰/۹۴ به دست آمد. نتایج کسب‌شده از تحلیل عاملی نشان داد که از دیدگاه روستاییان مورد مطالعه، آثار منفی بهره‌برداری از معادن در مناطق روستایی شهرستان تکاب در پنج عامل زیست‌محیطی، اجتماعی، اقتصادی، فرهنگی و بهداشتی قرار می‌گیرند و درمجموع در حدود ۶۰/۱۹ درصد واریانس را تبیین می‌کنند.

کلمات کلیدی: پژوهش توصیفی- تحلیلی، بهره‌برداری از معدن، آثار منفی، شهرستان تکاب.