The impact of Oil Installations on the Rural Development and Environment:
A Case Study of Taq Taq Oil Field

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ABSTRACT

There is no doubt that oil is considered as a strategic commodity for producing and exporting. It is been experienced that oil is an important means to achieve economic growth. The oil industries encounter conflicts such as widespread environmental issues, human displacement, and inadequate compensation for loses imposed in the oil producing communities and inadequate community level involvement. These are leading to alienation between states and the indigenous population. The aim of the current research is to investigate the impacts of oil fields development for rural areas, having Taq-Taq Oil Field in Kurdistan Region Iraq (KRG) as case study. The research project was conducted in the form of survey study. The population of the study included the rural residents in six villages around the field. The necessary data for this research was collected squarely 48 samples. Rural resident in the study area were taken using random sampling method. The reliability of questionnaire was calculated by Cronbach alpha coefficient for different sections. After conducting a pilot study for each structure respectively calculated: economic infrastructural, social, cultural and environmental factors. The results of factor analysis showed that the negative and positive impacts of oil industries development occurred in the rural area. In this case study a variance of %64 explained for entire factors included: infrastructural, social, cultural, economic and environmental.

KEY WORDS: Environment, Impact, Reliability, Rural Areas, Taq Taq Oil Field

1. INTRODUCTION:

The world is experiencing tremendous challenges entering into the 21st century. The enormous growing global population is expected to use more natural resources to achieve economic growth, while imperiling moral social values and degrading the environment (Tabucanon, 2010, p. 1). These gargantuan problems cannot be solved overnight. They have to be tackled collectively by all sectors of society; it is general consensus that Rural Sustainable Development (RSD) is the way forward . The goal of rural development which promotes social and economic development of local communities changes and looks for equitable distribution of income , increase Standards of living and creation job opportunities and the transfer of technology, the improvement of infrastructure in these areas, In most Gulf states, especially of Saudi Arabia the income and employment benefits to individuals, communities and regions, the income generated for central government is used directly in the provision of government services such as health, education, and welfare has been spending enormous resources on building the country's infrastructure almost from scratch (Khatib, 2012). But the experience of some countries in oil exporting to date illustrates few of these benefits . Result of Matthew Bliss (2014) study showed that the people met in all three countries in south Sudan feel that the losses and problems caused by the production of oil

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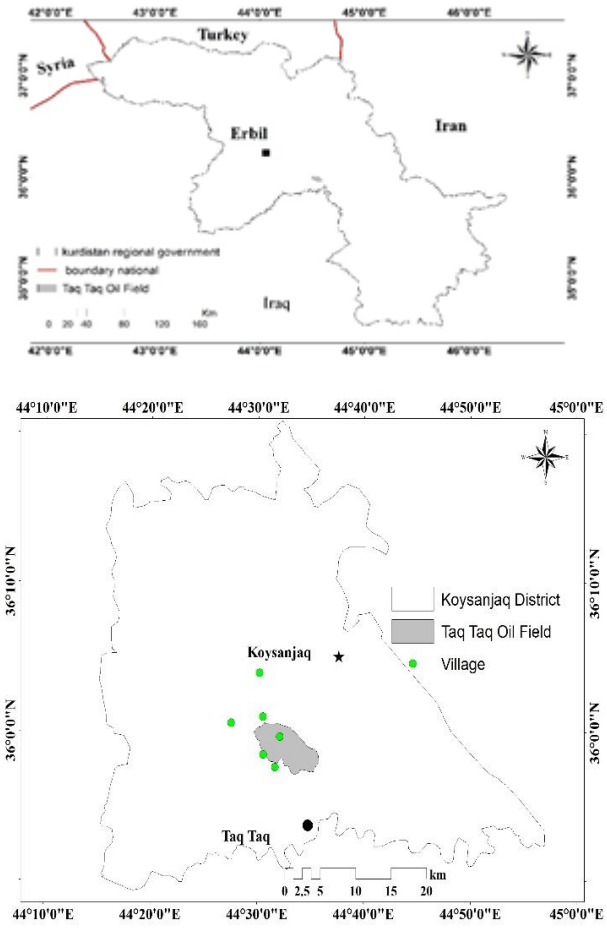
far outweigh the benefits. It seems that the companies did not have and do not have a policy for sustainable community development projects (Bliss, 2014, p. 6) .J.E.F Okpako's study (2014) entitled 'The Influence of Oil Activities on the Socio-Economic and Environmental Health Niger Delta Communities' showed that oil activities in the oil producing areas of Delta-State negatively influence the entire gamut of the lives of host communities socially as well as economically; moreover, it has a detrimental impact on the environment, their sources of nutrition, their health and general acceptable global standard of living (Okpako, 2014, p. 104) .

Kurdistan's region economy relies heavily on crude oil export revenues, representing about 95% of total export earnings and 80% of the government annual budgets (DeWeaver, 2015). Development of the oil installations in Kurdistan region contributes to the local economy by providing employment, the income generated is used directly in the provision of the services such as health, education, and welfare and process of improving the quality of participation of rural people in that process. KRG is an oil rich region the great majority of oil field are situated near the villages, and their activities face the rural settlements with harmful impacts; hence, expansion of oil installation 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. To reduce the negative effects and to increase the positive impacts of oil exploitations at the level of the study area, academic studies should be undertaken so that these results can be used to find good strategies, and apply solutions for effective oil management.The current study, therefore, focuses on the specific relationship between oil revenue and rural development in Taq Taq oil field Research Area. More specifically, it aims to examine, identify, and analyze the effects of Taq Taq oil field on the development of the surrounding villages.

2. RESEARCH AREAS

The Taq Taq Oil Field is one of the main petroleum zone in the Kurdistan Region approximately 60 kilometers northeast of the giant Kirkuk oil field and 85 kilometers southeast of the City of Erbil and 20 kilometers southwest city of koya , the study area approximately located between (44° 30'10-44° 35'21) eastern longitudes and (35° 58' 50- 36° 0'38) northern latitudes the approximate area of 1843 ha Fig. 1 .The Field was discovered in 1978 with the TT-01 exploration well and followed by two further wells, TT-02 in 1978 and TT-03 in 1981, all in the Crestal Area of the Taq Taq structure. Very little activity occurred in the field until the TT-01 and TT-02 started producing relatively minor volumes of oil for local use in 1995. In June 2009, Taq Taq oil started to be sold to local markets up to a maximum rate of m15,000 bopd. Since then, the product has mostly been sold both to the export market and local markets. In 2014, a new KRG pipeline became operational allowing export all the way to the Turkish port of Ceyhan.Althoug, in 2018, the Taq Taq oil Field had already 31 wells drilled, it has produced more than 180 MMbbl to date (Hamadamin, et al., 2019). At present about 6 villages around Taq Taq Oil Field has more than 1500 inhabitants.

Fig. 1.
Location of Study Area



3. METHODS AND MATERIALS

The main data-gathering method of this study is a self-administrated questionnaire. The intended questionnaire has three sections. The first section includes people's particulars such as age, education, secondary occupation, proportion of income from the main occupation, and educational degree. The second section includes the positive effect of Taq Taq Oil on the rural residents Field includes the variables (Infrastructural, Social, Cultural and Economic). These effects were investigated by using 13 variables. The third section comprises information about the negative effects

of the environment on the rural residents by using 6 variables.

The validity of the questionnaire was later examined and confirmed by the faculty members of the Department of Geography at the University of Koya. This statistical analytical survey aimed to study was carried out with field research approach and the questionnaires designed for rural resident who lived in the study area. The necessary data for this research were collected squarely from 55 members of this population (with the use of Cochran formula) rural residents in Taq Taq Oil Field were sampled by using a random sampling method **Table 1**.

TABLE 1.
Distances of Target Villages from The Taq Taq Oil Field and The Frequency of Their Sample Members

Target villages	Distance (kilometers)	Total population	Chosen sample
Elnjax	1	800	15
Shwashok Gawra	0	250	10
Marzan	2	210	10
Goptapa	6	160	10
Darbasar	3	50	5
Shwashok Bchuk	0	30	5
Total of six villages	-	1500	55

This statistical analytical survey was carried out with field research approach and the questionnaires designed for rural resident who lived in the study area. Cronbach alpha coefficients ranged from 0 to 1. The bigger the coefficient is, the higher the degree of internal consistency of the scale of each subject is, and the higher the reliability of the scale is, it will show full reliability. If alpha value is more than 0.7, questions and items are suitable for testing the concept or the related variable (Tavakol & Dennick, 2011). According to **Table 2** it is found that questions and items of the questionnaire is higher than 0.7. For this reason, it is scientifically valid to describe and test relations of variables. In order to analyze the data and conclude the results, the descriptive statistics as well as the factor analysis were used. Morover on that, the purpose of using factor analysis was to to determine the appropriateness of data and measure the homogeneity of variables the Kaiser-Meyer-Olkin (KMO) and Bartlett's test measures were applied. These statistics show the extent to which the indicators of a construct belong to each other. KMO and Bartlett's test got for these variables show that the data are proper for factor analysis.

TABLE 2.
Reliability Analysis (Alpha)

Scale Name No. of items in the scale Alpha value	Scale Name No. of items in the scale Alpha value	Alpha value
Infrastructural factor	5	0.627
Social factor	5	0.737
Cultural factor	4	0.745
Economic factor	4	0.601
Environmental Factor	8	0.713
KMO: 0.658 sig: 0.000	Bartlett's test: 7678.2	

Kaiser-Meyer-Olkin (KMO) and Bartlett tests should be performed before the principal component analysis. The KMO statistic varies between 0 and 1, and Kaiser recommends a bare minimum of 0.5 values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great and values above 0.9 are superb .Bartlett's test actually tests whether the correlation matrix is sufficiently different from an identity matrix. A significance test (the value of Bartlett's test less than 0.05) indicated that the variables were sufficiently correlated to provide a reasonable basis for a principal component analysis (Zhong , et al., 2014).

Based on the results of Kaiser-Meyer-Oklin test, the KMO statistics is 0.658, the Bartlett value is 7678.2 was got and because this value is larger than 0.5, it is concluded that the number of samples is suitable for factor analysis since KMO value is between 0 and 1 and the closer to one, the higher the sample validity. According to the above table, Bartlett's test of sphericity was got to be 7678.2 with significance p=0.000 and because this value is significant, it is concluded that the factors have not been classified well and the questions in each factor have congeneric correlative factor with each other. Factor analysis was applied as the main statistical technique to analyse the data. The main object of this technique is to classify many variables into a few factors based on relationships among variables. For this purpose, 18 variables were selected for analysis. Factor analysis is a statistical method that is based on the correlation analysis of multi-variables.

The purpose is to cut most variables to a lesser underlying factor that are measured by the variables Bartlett's tests of sphericity (BTS) are then applied to the studied variables to validate if the remaining variables are factorable. The KMO value should be greater than 0.5 for a satisfactory factor analysis (Jamshidi & Jamini, 2013).

4. RESULTS

1. Prioritization of Taq-Taq Oil Field Effects on the surrounding villages:

The results of this study indicate the most important positive impact of Taq-Taq Oil Field on its surrounding villages were new service jobs in the region, an increase in rural income, the improvement of the quantity and quality of transportation in villages, and better employment conditions for the educated. These are the most important effects from the perspective of the rural residents. Also, they indicate that the use of capital from the cities in rural regions, decreasing rural-urban migration, boosting the purchase power among the locals, pollution in rural regions, decrease in investment in agriculture sector, and degradation of rangelands in the surrounding villages are the most important negative effects.

2. Factor Analysis of the Positive Effects of Taq-Taq Oil Field

Based on the results of Kaiser-Meyer-Oklin test, the KMO statistics is 0.818, the Bartlett value is 4012.2 and its significant levels are 0.01. With respect to the KMO, four factors have high eigenvalue (more than 1) in the investigated region. The results of this test are indicated in Table 3. These factors explain 76.775% of the dependent variable variation. In this study, Infrastructural factor is the most important (its eigenvalue is 7.467). It explains 33.888% of total variation for Taq-Taq Oil Field and is considered as the main effective factor in the surrounding villages.

TABLE 3.
Number of Extracted Factors, Eigenvalues and Variance Explained by Each Factor

Factors	Eigenvalue	% of Variance	Cumulative % of Variance1
1	7.46	33.88	33.88
2	3.53	16.02	49.90
3	3.51	15.97	65.88
4	2.40	10.89	76.76
KMO: 0.818,	sig: 0.000,	Bartlett's test: 4012.2.	

The results in **Table 4** show that among the positive effects of Taq-Taq Oil Field on surrounding villages, the first factor (social factor) includes decreasing rural-urban migration, increasing on the awareness and expertise in rural regions, improving on the of security and increasing employment in villages, and improving the quality and quantity in local transportation. This factor explains 33.88% of dependent variable variation. Considering the loaded variables, these factors could be named social factors.

Immigration is the adjusting factor of population in given geographical spaces. It slowly moves the surplus of work force from some areas to the areas where workforce is needed. This improves the conditions of the areas which are facing population pressure and shortage of productive resources. The working abilities of many people in rural or non-rural areas would decrease if they remained in their own environment (and did not use their ability for any reason), causing a diminishing in their proficiency. Studies conducted in various rural areas reveal that lack of equitable distribution of income in different strata of the community leads to emigration from villages. According to the findings, farming is the main occupation of 43% of the people in the study area. However, considering the droughts of the last two decades in this area, farming has decreased. Therefore, if there is not sufficient employment and income, those villages will face emigration. In such conditions, constructing industrial parks could enhance employment and solve income problems for the residents of these villages. Results in Table 4 reveal that by increasing job opportunities in the villages under study, providing employment opportunities for some rural educated people, providing seasonal job opportunities for some farmers living in these villages, promoting awareness and skills among the villagers, a qualitative and quantitative improvement of transportation in villages. Therefore, it could be said that the construction of Taq Taq Oil Field has had the villages under study, providing employment opportunities for some increase of informal education, providing seasonal job opportunities for some farmers living in these villages, promoting awareness and skills among the villagers, a qualitative and quantitative improvement of transportation, Therefore, it could be said that the Taq Taq Oil Field has had the greatest effects in term of social factors. The factors ranked as secondary are presented in **Table 4**.

TABLE 4.
The Extracted Factors About Positive Effects of Taq Taq Oil Field with Their Factor Loading.

Effects	Variables	Factor Load
Social factor (%33.888)	Impact on the development education	0.872
	Impact on the Decrease the rural migration	0.871
	Impact on the awareness and expertise	0.748
	Impact on the of security	0.640
Cultural factor (%16.022)	Decrease of piracy	0.829
	Impact on the protection of women's rights	0.801
	Impact on the development of services internet	0.773
	Transfer live style	0.703
Infrastructural factor (%15.970)	Impact on the development of public roads	0.777
	Impact on the development of project electric and	0.723
	Impact on the transport services	0.673
Economic factor (%10.895)	Impact on the Decrease of unemployment	0.678
	Impact on the development agriculture	0.577

3. Factor Analysis of the Negative Effects of Taq-taq Oil Field

Based on the results of Kaiser-Meyer-Oklin test, the KMO value is 0.625, Bartlett value is 8848 and its significant levels are 0.01. With respect to the KMO, the environment factors have high eigenvalue (more than 1) in this region. The results of this test are indicated in **Table 5**. These factors explain 73.165% of dependent variable variation.

TABLE 5.
Number of Extracted Factors, Eigenvalues and Variance Explained by Each Factor

Factors	Eigenvalue	% of variance	Cumulative % of variance1
1	3.11	39.80	39.80
2	1.55	19.89	59.70
3	1.05	13.45	73.14
KMO: 0.625,	sig: 0.000,	Bartlett's test: 8848.	

According to Table 6, the environment factors among the negative effects of Taq-taq Oil Field on surrounding villages, include five variables namely those increase the destruction of pastures, increase the river water pollution, increase the noise pollution which impact on the increase of diseases in rural residents, and also decrease the groundwater.

The gases flaring of the facility adds to the pollution of the atmosphere as a result of the release of oxides of Nitrogen, Carbon and Sulphur (NO2, CO2, CO, SO2), particulate matter, hydrocarbons ash, photochemical oxidants, and hydrogen sulphide (H2S). These contaminants acidify the soil and depletes soil nutrient. Studies have shown that the nutritional value of crops within such vicinity are reduced. In some cases, there is no vegetation in the areas surrounding the flare due partly to the tremendous heat that is produced and acid nature of soil. The effects of the changes in temperature on crops include stunted growth and withering of crops.

Furthermore, there are adverse effects such as haematological effects on humans: The implication of gas flaring on human health are related to the exposure of those hazardous air pollutants emitted during incomplete combustion of flared gas. These pollutants are associated with a variety of adverse health impacts, including cancer, neurological and effects on reproduction, deformities in children, lung damage and skin problems have also been associated with gas flaring. Hydrocarbon compounds are known to cause some adverse changes in hematological parameters. These changes affect blood and blood-forming cells and could give rise to anemia (aplastic), pancytopenia and leukemia.

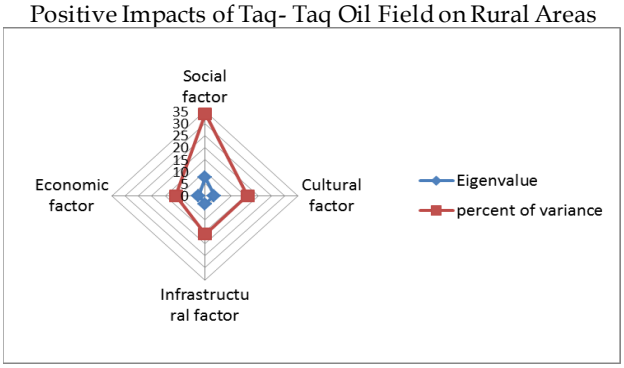
TABLE 6.
The Extracted Factors About Negative Effects of Taq Taq Oil Field on Rural Areas

Effects	Variables	Factor Load
Environmental factor (%73.16)	Increase the Destruction of pastures	0.957
	Increase the soil pollution	0.821
	Increase the river water pollution	0.762
	Increase the noise pollution	0.714
	Impact on the increase of diseases rural residents	0.702
	Increase the groundwater pollution	0.588

4. CONCLUSION

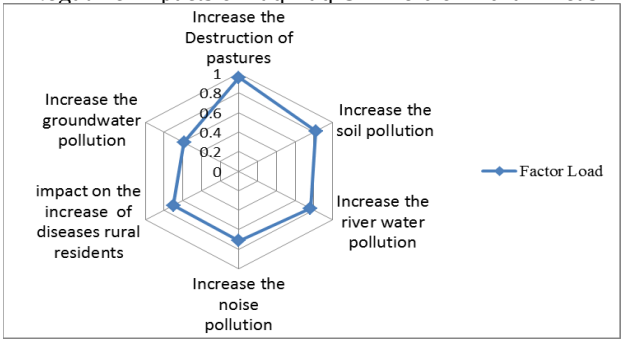
The aim of this work was to identify and analyse the positive and negative effects of Taq-taq Oil Field construction on the surrounding villages by using the survey method. The statistical population of this study is of 1500 residents in the surrounding villages around Taq-taq Oil Field. 48 members of the population were chosen as sample members by random sampling method based on Cochran's sampling formula. Based on the results obtained from the factor analysis, the positive impacts of oil installations development on the surrounding villages can be categorised into infrastructural, social, cultural and economic factors. These factors have explained 73.16% of total variance. Results of research showed that the development of oil industry in rural areas would provide the direct and indirect economic benefits. Social factors involve increase of security, decrease of rural-urban migration, increase of informal education, awareness and expertise; cultural factors comprise impact on the protection of women's rights, increase of services internet and effect on improving live style; infrastructural factors embody increase of suitable development of transport services, improve of suitable development of housing, increase of suitable development of public roads; and economic factors substantiate impact on the decrease of unemployment, suitable development of agriculture **Fig. 3**.

Fig. 3
Positive Impacts of Taq- Taq Oil Field on Rural Areas



Although, the results of research showed that the development of Taq-taq Oil Field indicate negative effects impact by factor analysis on Rural area that six factors have explained 73.14% of total variance, these include destruction of pastures, increase in the soil pollution, increase in the river water pollution, increase in the noise pollution, all of which impact on the increase of diseases rural residents Increase the groundwater pollution **Fig. 4**.

Fig. 4
Negative Impacts of Taq-Taq Oil Field on Rural Areas



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