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Modeling the assessment of socio-economical and environmental impacts of sand mining on local communities: A case study of Villages Tatao River Bank in North-western part of Iran

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ABSTRACT

Mining has a remarkable potential for production, employment, income distribution, socio-economical development in both local and national level. Among minerals, sand is extremely valuable and also the main source for building industry all over the world. However, this mineral mainly suffers from environmental problems such as erosion, land loss, loss of biological diversity and poverty increase among people. The present article tries to study the socio-economical and environmental impacts of sand mining and work sites located on Tatao River in the North-western part of Iran. It further attempts to assess the impacts of sand mining on local communities of the river bank. The collected data were analyzed through field study in the form of a questionnaire through SPSS and LISREL for the purpose of confirmatory and exploratory factor analysis and benefit-cost analysis. The findings of the exploratory factor analysis showed that the positive impact of these work sites on the site was 65.25% while the negative impact was %34.75. The findings of confirmatory factor analysis, on the other hand, revealed the most reliable variable was related to employment and environment preservation (R = 1). The findings of the cost-benefit analysis indicated that overall of the perceived benefits of the sand mining is greater than the perceived overall costs.

1. Introduction

Today, mining is one of the most important economic activities in many countries (Walsh et al., 2017), especially in developing countries (Aryee, 2001). Generally, Mining activities have a remarkable potential for production, employment, income distribution, economic, and social development at local and national scale (Tiainen et al., 2014); and there are different ways such as exploitation of underground, surface for mining purposes (Bebbington et al., 2008; Bury, 2002; Canel et al., 2010). In the past few decades, in many parts of the world, due to rapid economic development, River Sand and gravel have been widely used as materials for construction, and the demand for it along with the expansion of transport, construction and infrastructure has been broadly increased (Sreebha and Padmalal, 2011). Extraction of sand as a free resource impacts income and costs economic sectors and local livelihoods (Kondolf, 1997).

Despite the importance of the extraction of sand and gravel from river mines in most developing countries, the details of its economic, environmental, and social geology are not completely clear. The appropriate assessment of environmental impacts is often a hard task because the impacts appear after a long period of time. The main problem is the need to reinforce a holistic approach in the planning and managing these resources. The illegal extraction in most river systems also aggravates the situation. As a consequence, it is necessary to increase public knowledge and control the extraction of the resources.

This article aims to present the effective mechanisms to control the sand extraction in order to conservation the local communities, decrease the destruction of the environment, and to facilitate sustainable and long-term logical use of natural resources around Tatao River in the Northwestern part of Iran. Through these activities, the researcher aimed at reducing social and environmental impacts to increase stable economic activities for the purpose of establishing stable local communities in this region. During the last two decades, this area has witnessed excessive exploitation of sand due to economic development and increase the number of buildings. The results of different research reveal that the extraction of sand has outnumbered its natural regeneration in most parts of Tatao River, and this has caused a severe destruction of the environment and ecologic disorders in sediment making from upper parts of the river. One of the other drawbacks is in the peak times of extraction, the canal erosion of the river in its

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different parts is brought about. This, in turn, has led to ecologic and social dangers such as field destruction, water pollution, and air pollution, caused by truck traffic and local battles. Due to the importance of the scientific assessment of the rate of environmental destruction, caused by excessive sand mining, the present article aims at searching some social, economic, and environmental impacts of sand mines in Tatao river basin.

The present article aims at:. investigating and assessing the environmental impacts of sand mining from rivers. investigating social problems caused by sand mining from river mines. investigating economic impacts of sand work sites on local communities

Considering these goals the article tries to answer these questions:

1. What impacts have the sand mining has on the rural environment?
2. What socio-economic impacts have sand mining had on local communities?
3. What impacts have the establishment and the expansion of sand work sites had on economic sustainability?

2. Literature review

2.1. Environmental impact assessment of sand mining (EIA)

From the late 1960s, environmental impact assessment became common in projects. Environmental impact assessment predicts the probable environmental effects caused by implementing developmental projects, recognizes some ways to lessen or eliminate these unacceptable and unwelcome effects and presents the predictions to the decision makers (Dalal-Clayton et al., 2003). The aim of the environmental impact assessment is to produce the necessary information for the decision-making process in order to diminish and compensate the negative environmental consequences. Therefore, using the environmental impact assessment, trying to avoid negative environmental effects, or reduce them and maximize the positive ones (Macfarlane and Mitchell, 2003). Because of human activities, rivers all over the world are under pressure and the excessive sand mining is an activity which threatens rivers ecosystem (Kondolf, 1997; Rovira et al., 2005). The fact is that in the last decades, the environmental effects of sand mining from rivers have been understood and scrutinized (Sreebha and Padmalal, 2008). Some relevant studies have been conducted in this regard (Ashraf et al., 2011; Chauhan, 2010; Padmalal et al., 2008; Saviour, 2012; Sreebha and Padmalal, 2011; unep, 2014; Virah-Sawmy et al., 2014) Although the received information about sand mining in developed countries is reliable (Krausmann et al., 2009), lack of worldwide data about the extraction of materials has caused environmental problems and helped to lack of awareness (unep, 2014). That is why the extraction from these mines leads to the environmental degradation in both small and large scale (Makweba and Ndonde, 1996). River sand is a non-renewable resource in the human life cycle. If its extraction equals its regeneration, the environmental effects are minimal. But excessive extraction hinders ecosystem natural operation (Sreebha and Padmalal, 2008). The destruction of public properties, the destruction of water sources, the degradation of local communities livelihood, and the loss of the quality of the soil are all the results of excessive extraction (Ashraf et al., 2011; Viswanathan, 2002) and it also results in such effects as noise, dust, air pollution, heavy traffic around the mine, and landscape change (Aryee, 2001; Willis and Garrod, 1999). These effects have a negative potential for environment, society, cultural heritage, the mine workers' health and security, and mine neighborhood communities (WorldBank, 1998) and have caused the erosion of soil, the loss of the arable lands, the destruction of life diversity, and the increase of poverty among people (Erskine and Green, 2000). Although people are generally familiar with the importance of the sand in construction, they may not be aware of its negative effects on plant coverage, life diversity, and food security (Moran et al., 2014).

2.2. Socio-economic impact assessment of sand mines

One of the major areas of impact assessment is the social impact assessment (Becker, 2001). This kind of assessment normally includes an ordered attempt to recognize, analyze, and evaluate the social impacts of projects or policies on people, groups, or local communities as a whole group (Brouwer and van Ek, 2004). Sometimes, the social impact assessment, as an independent variable, is carried out in parallel with the environmental effects or independently as well. Yet, some believe that social impact assessment is the assessment of the social and cultural consequences of the private and public activities on communities in a way that these activities change life, workstyle, interactions, organization of needs, and finally social members participation (Farahani, 2007). Social impact assessment always starts with the analysis of population characteristics such as changes in population and employment patterns, resettlement, disorder in neighborhood, effects on noise and aesthetics dimensions, change in accessibility, the effect on hobbies and free times, sanitary and security, citizens' reactions, effects on local society, change in the pattern of using lands, and so on (Finsterbusch, 1980). One of the other negative social consequences is creating conflicts of competition in the use of agricultural lands, especially in areas where the agricultural lands are scarce and restoring them after extraction is possible (Ross, 2006). Musah and Barkarson studies in Ghana showed that sand and gravel extraction causes loss of the main resource of livelihood of the local people (farmland) (Musah and Barkarson, 2009). It also affects the culture of local communities. In addition, the pits caused by sand extraction has been left to its own, giving rise to the collection of all kinds of contaminants, especially malaria mosquito. Consequently, the health of local communities is alarmingly affected (Musah and Barkarson, 2009) In another study, Khan and Sugie (2015) conducted a survey-based research of the sand mining and its social impact on the local rural community in Bangladesh. They found that sand and gravel mining is a growing concern for the people whose property is near the river basically due to the fact that river erosion in the region has become a man-made disaster. In their study, it was also shown that the business and sale of sand has caused a significant damage to the roads and the conflict between local residents (Khan and Sugie, 2015). Ayenagbo et al. (2011) argued that a wide inequality and social injustice are caused by profitable activities of sand extraction (Ayenagbo et al., 2011) At the same time, the activation of these mines as an important economic resource can bring positive economic effects on a region through employment and increase in income, unemployment reduction, and diversity in income resources, leading to a rise in living standards (Wälde, 1992).

In 2015, Davi and Rongmei, having surveyed the impacts of sand mining in the region of Manipur on the river Aymfl, besides referencing negative environmental impacts of sand and gravel mining, additionally shows the positive impacts on workers' income as one of the important activities in economic development (Devi and Rongmei, 2015). On the one hand, these mines can create direct and indirect employment chances. For example, local small jobs, especially for drivers and those who provide them with goods and services are created, which in turn results in the changes in wage level in particular and income differences in a region in general (Clark, 1996). On the other hand, this can be effective in local mine workers' income (Sreebha and Padmalal, 2008)

On the whole, review of the related literature reveals that the extraction process is a bi-directional phenomenon. On the one hand, it creates an opportunity to an enormous wealth; on the other, it brings social collapse. Struggles and fights, dependence and unemployment, loss of identity and society order, loss of control and social order, citizenship and the destruction of existed cultural values, events and crimes, unreal expectations, conflict, inequality, loss of arable lands in the face of increase in national income, infrastructure improvement, accommodation, education, sanitary and education, and direct and indirect employment are all the secondary results of mines business (Macfarlane and Mitchell, 2003).