

IMPACT OF LOCATIONAL FACTORS ON THE PRODUCTION OF STONE CHIPS IN QUARRY INDUSTRIES: A CASE STUDY OF RAJMAHAL HIGH LAND REGION OF INDIA

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Abstract

Stone quarry industry is one of the most important mining industries in India. It plays an important role in the economy of the Rajmahal high land region. The present situation of Rajmahal high land region reveals the proper condition for establishment of quarry industry. But there are some constrains which may stop the growth and development of that industry. Now-a-days, Cost of labour, capital investment, organizational abilities, infrastructures and cost of production etc. have created problem for quarry industries. The present paper based on intensive field study involves and focuses on the impact of locational factors on production of stone chips in quarry industries of Rajmahal high land region in India.

Keywords: Quarry, stone chips, locational factors, economy

Introduction

India is a country where the government administers the state with the help of socialistic pattern of mode of production of economy. The location policy of industry under such pattern differs from the “Free enterprise” economies. Weber tries to prove the raw material orientation of industries, where as Losch centers his studies on market relationship for their location. Under socialistic pattern mode of production of economy, proportions in economic opportunities between regions expected, therefore abnormal agglomeration of industry in growth regions may not take place. In a developing country like India, the development of industries are necessary in backward ,declining , stranded, ruined areas, where depleted resources ,unemployment and over specialization are the major problems. For that purpose, the location and development of industry should be made in such a way which uplifts the whole national economy.

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Objectives of the Study

The study possesses following objectives-

- To study the impact of availability and cost of inputs on the production of stone chips in quarry industries.
- To examine the impact of availability and cost of labour on the production of stone chips.
- To enumerate the impact of capital investment on the production of stone chips.
- To discuss the impact of organizational abilities on the production of stone chips.
- To examine the impact of infrastructures on the production of stone chips.
- To observe the relationship between cost of production, gross profit, net value of production of stone chips
- To uncover the problems arising out of above mentioned impacts and to suggest policy measures.

Data Base and Analytical Procedure

Data have been collected from two sources - 1) Secondary 2) primary. Secondary sources of data regarding number and location of stone quarry industries have been collected from SLRO and BLRO offices of different police stations of the study area. Mining and mineral data regarding problems, pollution and environmental degradation have been collected from the journal entitled "Safety mine week". Data regarding act and regulation is obtained from the office of West Bengal Mineral Development and Training Corporation Punchami of Md. Bazar police station. Apart from this, some preliminary data and information of this area have been derived from district census handbook, Birbhum and Sahebganj.

Primary data have been obtained from field investigation. There are roughly 700 stone quarry industries located in the entire region. Out of this, nearly 12% of the quarry industries of different sizes have been randomly chosen for the study. Primary data have been collected in respect of a) resource b) capital c) labour d) organization e) infrastructure and facilities f) actual potential needs and characteristics of stone quarry industries.

The above mentioned data have been processed statistically and some simple tables have been framed. The entire relationship between different variables has been identified by means of co-relation analysis. Co-relation matrices have been formulated with the help of co-relation coefficient. The cause and effect relationship between independent and dependent variables have been computed with the help of regression analysis. Out of the total number of quarry industry, 80 have been selected randomly for field investigation and then their detailed analysis has been done considering their size. The above mentioned impact assessments will be done by means of product moment correlation analysis.

The Location and Geographical account of Rajmahal Highland Region

The study area is located in between latitudes 24°45'N and 24°50'N and longitudes 87°35'E and 87°25'E in Rajmahal volcanic tract of Sahebganj district in Jharkhand and 23°32'N to 23°35'N latitude and 88°01'40''E to 87°05'25''E longitude in Birbhum district in West Bengal. The Rajmahal hills in the north eastern fringe of the Chhotanagpur plateau are covered with lava flows which were probably linked with the initiation of the Himalayan Orogeny . Rajmahal Traps consist of dolerites, basalt and andesite rocks. Genessic and granitic Pre Cambrian land surfaces are also found there. Massive sandstones of Mahadeva series (Middle Gondwana) were formed. Rajmahal highland comprising a chain of level lava plateaus, sculptured hills interrupted with valleys and undulating dividing surface. These hills extend north-south rising 300-450 meter above the general plateau surface during the upper Gondwana period, the Gondwana land was subjected to marked vulcanicity ,which manifested itself into out pouring of Rajmahal lava flows and intrusion of numerous sills and dykes of basic and ultra basic rocks. The plateau is covered with the red soil of the gneiss and granite surface with the exceptions of loose sandy soil .Over the lava surface black clay and laterite soils are found which are hard though friable when dry. This region experiences the characteristics of monsoon climate. With the commencement of hot weather in March, the temperature rises until May. The monthly mean ranging from 29°C-32°C creates a low pressure over the area .During rainy season, June- October, the temperature begins to decrease. The average annual amount of rainfall ranges between 100 cm and 150 cm. The cold weather season commences from November and lasts till the end of February. The January temperature remains above 16°C.

Annual Production of Stone Chips

The highest and lowest amount of stone chips are produced in the quarry industries of area under Murarai (18 Lakh cft) and Nalhathi PS (50 thousand cft).The larger amount of it is produced in area under Pakur PS which is explained in details in Table-1.

Table -1 Annual production of stone chips in thousand cft

Name of the police station	Total industries	50-116 ('000 cft)	116.1-182 ('000 cft)	182.1-250 ('000 cft)	250.1-1800 ('000 cft)	Average ('000 cft)
Rampurhat	13	02(15.38)	07(53.85)	04(30.77)	-	159.88
Nalhathi	16	04(25.00)	07(43.75)	03(18.75)	02(12.50)	254.90
Murarai	09	01(11.11)	04(44.44)	02(22.22)	02(22.22)	351.70
Pakur	27	-	-	03(11.11)	24(88.89)	919.70
Sikaripara	01	01(11.11)	-	-	-	83.00
Md.Bazar	14	06(42.86)	05(35.71)	01(07.14)	02(14.29)	250.93
Total	80	14(17.5)	23(28.75)	13(16.25)	30(37.50)	477.30

Source: Field investigation, 2010-11.

Note: Figure inside the bracket shows the percentage of industries

It is distinct that the northern (Jharkhand) and central part (Bibhum, West Bengal) of the region produce more amount than the southern part (West Bengal).

Impact of Availability and Cost of Inputs on the Production of Stone Chips

The study area is plain with some undulations exist in between. This kind of topography is suitable for storage of materials and finished products, parking of cars and trucks, internal circulation and room to expand for quarry industry. This site is suitable for having fixed capital resources and boulders are either located very close to earth surface or are exposed over it. Besides, this site is favoured by electricity and transportation. Most of the mining areas is located within 1 Km from the industry.

The land value is in between 24 lakh and 30 lakh per acre in the small town, which is much smaller in this industrial and mining area which is about Rs. 180,000 only per acre, indicating cheap value of land. A considerable portion of the land of the region is owned by *Santhal* (scheduled tribe) communities which are very much sterile and unproductive for agriculture.

The owners of the industry take the land on lease and pay nominal amount to many of the Santhals, who become happy even with that small amount of money, whereas owners make larger amount of profit from that the organized industrialists, thus explain the economy of the disorganized Santhals to a large extent. The study indicates that the quarry industries which produce large amount of production have relatively smaller area where the industry and the boulder mining areas are located.

The quarry industries require boulders as raw materials which are converted into stone chips having greater value. This raw material is of extractive nature. The boulders are not only bulky but also possess large weight and are localized in different parts of the region. In general, the industries obtain boulders from mines located roughly 1 Km from it. That is why; the transport cost to carry boulders is not higher. Keeping parity with it, as the surface mining is practiced, therefore the cost of mining is not reasonable. Some industries require as large as 24 lakh cft of boulders annually whereas most of them need 3 lakh cft annually and a large number of industries located at area under Pakur and Muhammad Bazar police stations require larger amount of boulder for the purpose.

As far as machineries are concerned, crusher machine and other tools are required to run this industry. Although, a few industries invest Rs 30 lakh to purchase those, but most of them invest Rs 4 lakh only for this purchase and large number of industries located at area under Pakur and Md. Bazar police stations invest larger amount of money to purchase machineries. The impact of inputs on the production of quarry industries can be observed from the table-2.

Table -2: Relationship between stone chips production and different inputs

Variable Y	Variable X	R value	t value	Significance level
Amount of stone chips production	Total amount of industrial and mining area	(-)0.02	(-)0.07	Insignificant
Amount of stone chips production	Total amount of boulders used	0.88	6.94	0.01
Amount of stone chips production	Total cost of machineries used	0.58	2.66	0.05
Amount of stone chips production	Distance between mines and industries	(-)0.45	(-)1.88	0.10
Amount of stone chips production	Material index	0.02	0.07	Insignificant

Source: Field investigation, 2010-11.

An interesting point to be noted here is that the weight of stone chips is larger than boulder in all the industries, but due to bulkiness and huge weight, the industries, are located near raw materials.

Impact of Availability and Cost of Labour on the Production of Stone Chips

Different sizes of quarry industries engage workers ranging between 10 and 800 and most of them engage roughly 40 numbers of workers who are either skilled or unskilled or are clerical and managerial staff members. Most of the industries spent nearly half of their total cost of production as labour cost. These industries require relatively larger number of unskilled labour than the skilled labour which determines its location either near small town or rural areas. Large numbers of male workers are needed in boulder mining and large number of female workers is required to run the stone quarry industry. Therefore, these industries are located in the backward region where large proportion of female population belonging to backward communities resides and the workers come from areas within 5 km from the industry. The wage rate is not very much attractive in this industry, therefore, during sowing and harvesting time of crops, most of the unskilled labour prefer to work in agricultural field as labour and whenever they cannot find any suitable job, they came back to quarry industry. There is no fixed amount of wage for the workers, who work more get larger amount of wage and vice-versa. This kind of management policy encourages to the unskilled labourers and they work with more enthusiasm which on the other hand encourages the industry to increase its production. The workers of this industry reside in periphery part of urban centers where wage rate is relatively smaller because the cost of living is minimum there. The study region is the labour surplus area where supply of labour is larger than demand which cannot raise the wage rate to a large extent rather it is done with the negotiation with the trade unions for

maintaining uniformity of wage rate, however this rate is close to the subsistence level of economy of those workers.

The large sized quarry industries have their own mines where large number of male workers is engaged, but small sized industries have to purchase boulders from other mines, therefore relatively smaller number of male workers is engaged in their industries.

The study explains that large sized industries generate larger amount of profit and income which sometimes encourage them to pay larger amount of wage and salary to the workers than the small sized industries which often creates disparity between them. The rainy season is not suitable to carry on this industrial production continuously. That is why the industries engage relatively larger number of seasonal labour.

Index of labour indicates ratio between cost of labour and total amount of production of stone chips in an industry (in terms of weight and monetary value). In large sized quarry industries which produce larger amount of stone chips in a year, incur smaller amount of cost of labour per unit of stone chips. Coefficient of labour reveals ratio between cost of labour and cost of boulder. In large sized quarry industries which produce considerable amount of stone chips in a year, incur smaller amount of cost of labour per unit of cost of boulder. These facts behave reverse in case of small quarry industry. The impact of labour factor on the production of stone chips is reflected from the table-3.

Table 3: Relationship between annual production of stone chips and labour factors

Y variable	X Variable	R value	T value	Significance level
Production of stone chips in Cft	% of unskilled labour	0.80	4.98	.01
	% of skilled labour	0.66	3.29	.01
	% of male unskilled labour	0.42	1.73	.50
	% of female unskilled labour	0.31	1.22	.50
	% of male literate unskilled labour	(-)0.39	(-)1.58	.50
	% of female literate unskilled labour	(-)0.49	(-)2.10	.10
	Average daily wage of unskilled labour	0.48	2.05	.10
	Average monthly salary of skilled labour	0.50	2.16	.05
	% of full time labour	(-)0.31	(-)1.23	.50
	% seasonal labour	0.28	1.11	.50
	Labour index	(-)0.29	(-)1.13	.50
	Co-efficient of labour	(-)0.27	(-)1.05	.50

Source: Field investigation, 2010-11

Impact of Capital Investment on the Production of Stone Chips

Present study indicates that out of total amount of monetary capital resources, roughly 75% are owned by the owners and rest is taken from bank or any other sources. The owners deposit their

money in the local banks and use them whenever industries need it. Besides this, they get bank loan from the local banks only. Sometimes, some of the sick quarry industries get lump sum amount of subsidy from the government. It is often found that the owners belonging to scheduled castes communities are favoured with considerable amount of subsidy which is invested in these industries. Some owners who are not influential persons have to face serious difficulties in getting bank loan. In that case, the owners have to pay money up to 25% of the total bank loan to the bank manager or to the particular authority to get required amount of loan from the bank. However, often the owners of big stone quarry industries get huge amount of loan from the big bank located at metropolitan cities, but ordinary owners of small stone quarry industries cannot do so. It is also observed that several schemes are launched in this region from time to time. From these schemes, some monetary benefits are provided to these industries. But these schemes do not operate continuously.

The stone quarry industries possess small building for storing some equipment and for use of office. These industries are located on level and plain topography so that if required, these industries can expand horizontally. These are located on plain topography where homogeneous resources are available, therefore, the initial investment and cost for the location of these industries are almost uniform in nature and do not vary significantly. The machineries of these industries are easily obtainable and servicing facilities may also be available within a maximum distance ranging in between 4 km and 15 km. Sometimes, these machineries are required to be brought from Gujrat, Maharashtra and Delhi and servicing of these machineries are available from Kolkata. The impact of capital investment on annual production of stone chips can be observed from the following relationship between them.

Table 4: Relationship between production of stone chips and capital investment

Y - variable	X - variable	R - value	T - value	Significance level
Annual Production	Total amount of fixed capital	0.61	2.88	0.02
Annual Production	Total amount of recurring capital used per day	0.57	2.60	0.05
Annual Production	% of capital investment in winter season	0.09	0.33	Insignificant
Annual Production	% of capital investment in summer season	(-)0.74	4.07	0.01
Annual Production	% of capital investment in rainy season	0.42	1.73	0.50
Annual Production	Total amount of capital investment in a year	0.89	7.30	0.01

Source: Field investigation, 2010-11.

Impact of Organizational abilities on the Production of Stone Chips

In this region, except very few stone quarry industries, most are owned by the private owners. But there are few which are owned by the government of West Bengal, like West Bengal mineral

development and Trading Corporation at Panchami of Mahammad Bazar Block. These types of organization can affect the motives and behavior of the authorities who take such decisions. The owners are interested to maximize their profit, without taking care of the welfare of workers and needs of the society. They are also interested in the long term security of the quarry industries. The locations of these quarry industries are quite satisfactory but this location is not favoured by agglomerations of economies although physical aspects and resource position are quite attractive to these industries. However, some essential facilities are rare there. The owners of stone quarry industries may have a typical attitude which influence the location of stone quarry industries in this region. The industries are located near to the raw materials and infrastructures from where their industries can sustain fully. The existing pattern of home trade suits them. They do not like to move to a new location, because the transactions about the input and output with which they are associated seem to be favourable to them. They are of the opinion that if they move then they are not sure whether they can make further higher rate of profit or not. Whenever there is a serious problem associated with the function of machineries, then the management may take the help of technical experts of metropolitan cities. Apart from that, once in a year the management may organize a "safe week" programme. In that programme, various technocrats and eminent scholars, engineers etc. are invited. They come and provide scientific opinions which favour the functions of stone quarry industries.

Impact of Infrastructures on the Production of Stone Chips

Transport

As most of the stone quarry industries are located nearer to the mining centers, the transport cost is minimum for bringing boulder from mining centers to the stone quarry industries. But the produced stone chips are sent to different parts of the state and country. There is considerable amount of transport cost for bringing stone chips to different sale points. The distribution of stone chips is mainly done by means of two ways- (1) the middle man merchants bring the stone chips from the quarry industries by hiring their own transport vehicles and accordingly the middle man merchants distribute stone chips as per requirement to different persons concerned and (2) the middle man merchants who reside in the distant parts of the state near Kolkata get stone chips through railway transport up to Dunkuni. From there, they distribute this item to different sale points. But in this case, the entire transport cost of road and railway is being borne by the middle man merchants.

In this study area, the transport network is not well established. The black topped roads are rarely seen to connect mining areas with the stone quarry industries. In most cases, the unmetalled roads are made of laterities or wasted boulders materials and bricks, stone dust materials etc.

The heavy down pours produce a lot of pot holes on the roads. Due to this reason, heavy vehicles cannot run smoothly which increase not only the cost of transport but also damages the parts of heavy vehicles. The roads from quarry industries to different sale points (mostly metalled roads) are not properly maintained. The stone chips and the boulder rocks are not only voluminous but also bulky.

These materials are neither weight loosing nor perishable. This item requires relatively smaller amount of transport cost for its movement. Sometimes, railways are used to transport stone chips. In that case, loading and unloading costs which are included within terminal cost and the line haul costs became neither very high nor very small.

Table 5: Relationship between production of stone chips and other variables related to infrastructures

Y-variable	X-variable	R-value	T-value	Significance level
Annual Production	Transport costs for machineries assembling	-.55	-2.48	.05
Annual Production	Transport costs for marketing of stone chips	-.16	-.61	Insignificant
Annual Production	Distance between industry and sale point	.58	2.68	.02
Annual Production	Market price for the amount of 200 cft of stone chips	.35	1.40	.50

Source: Field investigation, 2010-11

Market

In most cases, middleman merchants purchase stone chips and sale them to other persons. Here, quarry industry finds its major market area within the urban centers and to its surrounding areas and that is why, it is located not very far from the major urban centers. Some advertisements are to be made by this industry through their journals for further explanation of markets. These industries have potential customers in and around urban centers where construction works are performed. In these urban centers, the people have higher per capita income and purchasing power; therefore they can invest money to construct brick built buildings where stone chips are required. Besides, Government has to build large number of buildings welfare arrangements and roads which are made of stone chips.

The Relationship between Cost of Production, Profit, Gross and Net Value of Production and Production of Stone Chips

There are some quarry industries which produce relatively larger amount of stone chips annually. These industries produce significant share of their production although reduces from December till May i.e. winter and summer months. Keeping parity with it, these industries invest larger amount of money from June till November and the amount reduces thereafter till May. Due to heavy investment, these industries earn considerable amount of profit, gross and net value of output annually. Besides, these also generate larger amount of net value added per worker and per unit of capital. The above mentioned industries produce larger amount of stone chips per unit cost of

production (index of manufacturing) and incur larger amount of cost of production per unit of weight of boulder as raw material (co-efficient of manufacturing).

Table 6: Relationship between production of stone chips and cost, value of production and profit

Y-variable	X- variable	R-value	T-value	Level of significance
Amount of annual production	% of production during summer season	-.02	-.07	Insignificant
Amount of annual production	% of production during winter season	-.02	-.07	Insignificant
Amount of annual production	% of production during rainy season	.56	2.55	.05
Amount of annual production	% of cost of production during summer season	-.51	-2.22	.05
Amount of annual production	% of cost of production during winter season	.12	.45	Insignificant
Amount of annual production	% of cost of production during rainy season	.33	1.31	.50
Amount of annual production	Total cost of production	.89	7.30	.01
Amount of annual production	Total cost for welfare activities	.21	.80	.50
Amount of annual production	Total amount of profit	.71	3.77	.01
Amount of annual production	Gross value of output	.78	4.66	.01
Amount of annual production	Net value of output	.71	3.77	.01
Amount of annual production	Net value added per worker	.32	1.26	.50
Amount of annual production	Net value added per unit of capital	.14	.53	Insignificant
Amount of annual production	Net value added per unit of produce	-.52	-2.58	.50
Amount of annual production	Index of manufacture	.41	1.68	.50
Amount of annual production	Co-efficient of manufacturing	.01	.04	Insignificant

Source: Field investigation, 2010-11

Problems and Prospects

The poor, illiterate owner of the land receives small amount of money. But owner of the industry earn large amount of money. Expert mechanics are not available in local area. They are brought from Kolkata or large town. Small wage and late payment, Misbehavior, misguided by politicians are common. The labourers do not work properly, the entrepreneurs try to exploit the labourers and the labourers try to escape from their duty and union supports them. The transaction of stone chips is done by seller-loader-purchaser chain. Sometimes sellers influence loader to control buyer and sometimes opposite holds good. Infrastructures, facilities, amenities, welfare arrangements are poor and less than their requirements and there is no security of their life and service. The wage distribution policy and system are like that the monthly wage of labour is often higher than supervisors. So, labourers disobey supervisors and supervisors are frustrated. 25% of the loan is to be given to the bank manager as bribe. Accident happens due to negligence the act rule and regulations. Traditional technologies and machineries are used. For the execution of any lease of mineral deposits, it takes time which sometimes dampens the zeal of young entrepreneurs. Forest act is another recent impediment for mineral exploration conducted in forest area. All these problems and delay give way to clandestine mining, resulting loss of revenue and occasional irreparable damages to mineral properties. The surface rent and taxes of lease hold areas, royalty, on minor minerals differ from state to state.

Conclusion

Quarry industries lay foundation stone to build the economy of any region. Because the stone chips are used not only for construction of the railways or roadways but also for the construction of buildings. Therefore, government should plan for the betterment of this industry. Several physical, socio-economic and politico-administrative constrains stand in the way of proper functioning of this industries. The poor labourers are affected seriously by the dust pollution which decreases their labour efficiency to a considerable extent. This ultimately causes the decline in the overall production. Apart from this, the availability of capital and other infrastructure and facilities cannot provide incentives for the betterment of this industry. Therefore, an integrated planning management is required to overcome these constrains which stand in the way of its development. Along with this, the technocratic, democratic and bureaucratic integrated planning is necessary not only for the increase of production but also for the benefit of the people of the region. The poor Santhal owners and labourers are economically affected to large extent which should be taken care of their development and all these efforts will give rise to all sided socio-economic development of this region where stone quarry industry as a pivot, will play the role of catalyst.

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