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## Stress, Shock and Resilience: How Locals in the Periyar River Basin Adapted to the Ban on Sand Mining

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### Abstract

*Sand mining is one of the main livelihood option for the local people who reside near the river. The story of people near the Kerala's biggest river is not an exception. Hundreds of households find their livelihood from sand mining and associated jobs. But, 2015 due to excess exploitation of sand and other illegal activities associated with it, banned sand mining activities in the Periyar River. This was a shock to the local livelihood who doesn't possess any livelihood assets. What is the extent of livelihood shock and how the local community resilient towards this adverse situation and adapted to the shock is the main theme of this paper? The study basically uses primary data collected from 738 households through stratified random sample method to understand the situation. The study argues that the ban on sand mining was a sudden threat to all those who have involved in sand mining. Even though this particular livelihood doesn't require any particular asset bases, people who have created assets for their subsidiary activity during the sand mining could easily resilient to the shock. They could convert their subsidiary activity into their main activity when the ban was effective. Others find it difficult to cope up with the situation and had a desperate time. Nevertheless, the ANOVA results clearly shows that sand miners could not regain the level of income that they earned in the pre ban period during the post ban period. The article suggests that subsidiary occupation is the best tool to cope up with the stress and shocks associated with a particular livelihood.*

*Keywords: Sand mining, Livelihood, Sustainable, livelihood strategy, Livelihood diversification*

### Introduction

The construction boom happened in the 90s has created an extravagance demand for sand. This has opened a new livelihood option for the people who resides near the river. In Periyar River also lot of people newly attracted towards this newly emerged occupation and had great earning. Hence, Sand mining becomes a primary activity and main livelihood option of local community in the Periyar river basin. During the sand mining period most of them are involved in sand mining and allied activities. They earned better income and hence there was increased demand for products. This has paved the way for the growth of small entrepreneurs and other small business entities. Many of them had subsidiary occupation like lending, cultivation, animal husbandry etc. that they generated from the excess income they got from sand mining. This supplementary activities created bonus income to the household. But during 2015 Kerala government introduced ban on sand mining activities in Periyar river. This has created great shock in the livelihood of people.

### Review of literature

Several literature addresses the livelihood issues and environmental impact associated with sand mining in India and elsewhere in the world. Few studies in Kerala also which look into the socio-economic and environmental impact of sand mining in different rivers. But, none of the study basically address the issue related to livelihood threat due to ban on sand mining.

### Research Issue

Sand mining was main occupation for hundreds of households in the Periyar River. They had better income and better living standard during this time. They could educate their children and give better care for health issues. They could earn physical assets too through the money earned from sand mining. But due to excessive and unsustainable sand mining, government issued a ban on sand mining in 2015 prohibiting all the activities related to sand mining. This has created a mayhem in the area. In this context the study looks into how people managed the situation. How they cope up with this shock. How the livelihood transformation happened over the period. Whether there is any change in income in pre and post ban period. How people resilient towards the situation.

### Objectives

The objective of this paper is the impact of ban on sand mining in the Periyar River. What is the extent of livelihood shock and how the local community resilient towards this adverse situation and adapted to the shock.

### Data sources and Methodology

The study is based on primary data collected through structured interview schedule from 738 households who had been engaged in sand mining occupation. The survey data is supported by qualitative information derived from the field. The sand miners in this paper include truck drivers, sand contractors, sand diggers and loaders, both loading and unloading workers. The primary data is collected through a well-structured interview schedule.

### Livelihood

According to Chambers and Conway, 1992, “a livelihood comprises the capabilities assets (stores, resources, claims and access) and recovers from stress and shocks, maintains or enhances etc. capabilities and assets and provides sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihood at local and global levels and in the long and short run” (Chambers and Conway, 1992). Chambers and Conway expounds that, “a livelihood is sustainable when it can cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base” (Chambers and Conway). The peculiarity of sustainable livelihood is that will enjoy great security and they will be free from tight grip of tension. The function of livelihood sustainability is based on the way how people make use of the asset stocks in short term and long term basis respectively. The livelihood can be described or given in a word picture as the blend of the human ability and the resource they have along with the activities they engage into earn a living and thereby fulfil their aims and desires (Chambers and Conway, 1992). Hence it can be stated that the livelihood will be sustainable when people are able to adjust with and overcome from the blows and calamities and stimulate their capabilities and possessions in the present and in future and at the same time not hurting the base of natural resources.

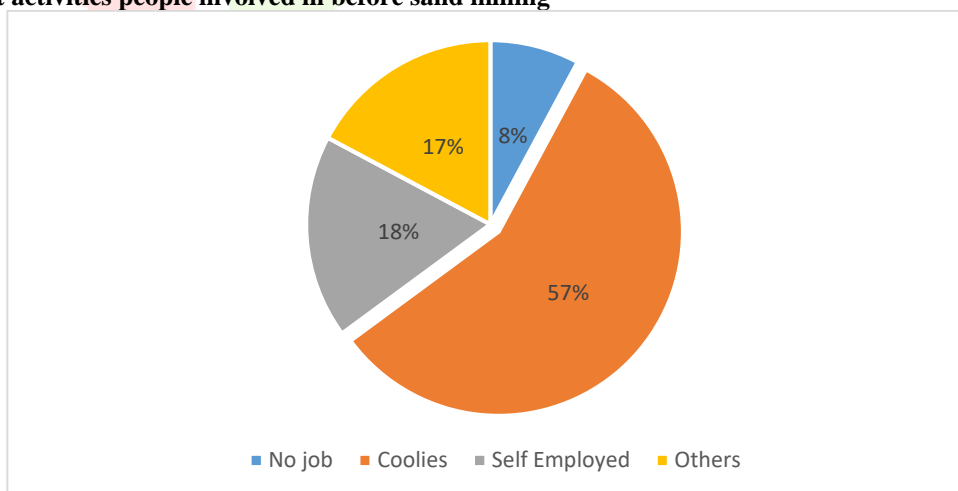
### Livelihood activities of Local Peoples

In this study, the activities engaged by people over the period has been addressed in three levels. The initial stage of enquiry pertains to the different activities people involved in before sand mining, then what was their main and subsidiary employment when Sand mining was introduced in the area, and finally how people adapted to the ban on sand mining. How people shifted to different occupations and adapted to the threat of ban on sand mining. How vulnerable they were and how resilient they were in adapting to the situation is addressed in the following session.

### Activities people involved in before sand mining

Figure: 1 indicate that 7.8 percent labourers had no job before they enter into sand mining job. Among them 58 percent of labourers were coolies, and around 18 percent of labourers were self-employed. They had meagre earning, job uncertainty and low standard of living. This is a clear indication that people are looking and wanting for job in these areas in those times. This enabled the labourers to easily switch over to sand mining occupation when it was introduced. Labourers found sand mining more comfortable and rewarding than any other job. The entry to sand mining was rather very easy and doesn't require any specific skill set or asset base. This was further an attractive factor that people are more attracted towards sand mining. In addition to that the work time was very convenient to the labourers as it began very early in the morning. On an average the labourers were doing sand mining job for four hours in a day. All these factors help them to engage in additional subsidiary activities like cultivation, animal husbandry and many other form of farm and off farm employment activities. Hence, it was inferred that sand mining had opened door to new employment opportunities.

**Figure: 1 Different activities people involved in before sand mining**

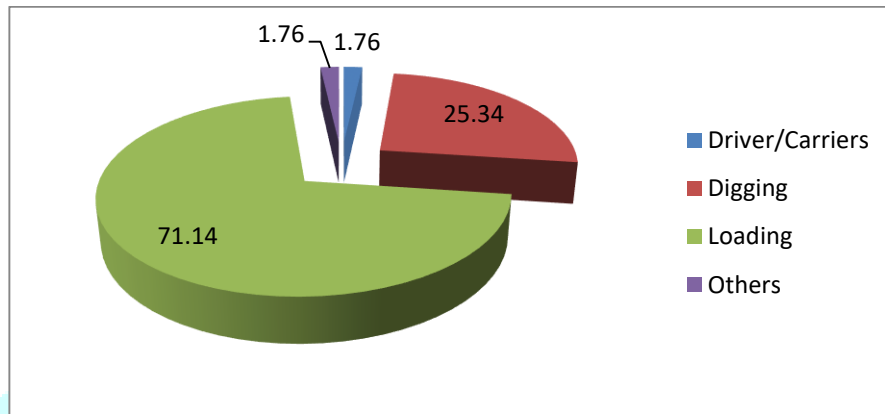


Source: Survey 2021

### Livelihood diversification during the period of sand mining

When the sand mining was introduced in Periyar River, considering its monetary benefit people started to flow towards sand mining. The job insecurity, inconsistent wage and stumpy standard of living of previous occupation also become a motive to opt sand mining as their livelihood option. The monetary benefit from sand mining and its utilisation based on certain factors such as working condition, number of years worked and number of sand mining labours in a family etc. There are several category of sand miners is engaged in sand mining activities in the selected area. Majority are labourers (54 percent), followed by licensed Employees (44 percent) and contractors (1.6 percent). They reported that almost half of them are working in the same field for about 20 years. This means that an employee considered sand mining as his occupation over his life time.

**Figure: 2 Sand mining Activity**



Source: Survey data, 2021

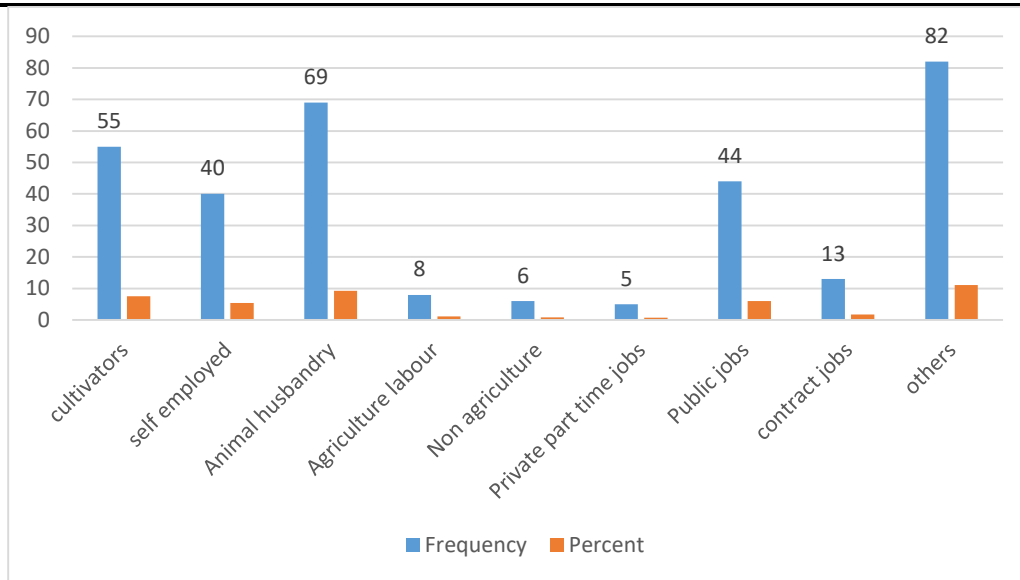
### Main employment during the sand mining period

Main employment is the primary job of a person who spend most time, which gives a regular income to them. It is the prime means of livelihood. During the period of sand mining, sand mining itself is the main employment of the people. Sand mining provides different occupational option directly and indirectly to both sand miners and other local people. Sand mining workers include sand contractors, organised and unorganised workers. Sand mining comprises activities like digging, loading and unloading, carriers or drivers etc., but all category come under the crown of sand miners. All are paid equally for every type of sand mining activity. Assured high income is the major attraction to this sector. Everyone gets a minimum of 1000 and a maximum of above 5000 per day during the peak time when the demand for sand is high. Their standard of living was far better than earlier. They can purchase assets such as land, vehicles, and animals, build big houses and have savings, investments. Provide better education to their children. Higher and certain income pave way to engage in another subsidiary activities to get additional income.

### Fist subsidiary Employment during the sand mining period

Subsidiary employment encompasses of cultivators, farmers both agriculture and non-agriculture, Animal husbandry, self-employed, private and public full time jobs and part time jobs, contract jobs and others .Out of 738 respondents 322(44%) of them have first category of employment such as poultry farm, workshops, private, financing, textiles shops etc. which requires huge investment. High income from sand mining help them to invest in these activities. Among these majority (82) of them come under others such as small scale and cottage industries, electricians, drivers etc. and some service providers like blacksmiths, nurses, teachers, washer men, weavers, barbers, cycle repair mechanics also included in this activity which is not a time bound activity to them.

**Figure: 3 Fist subsidiary Employment during the sand mining period**

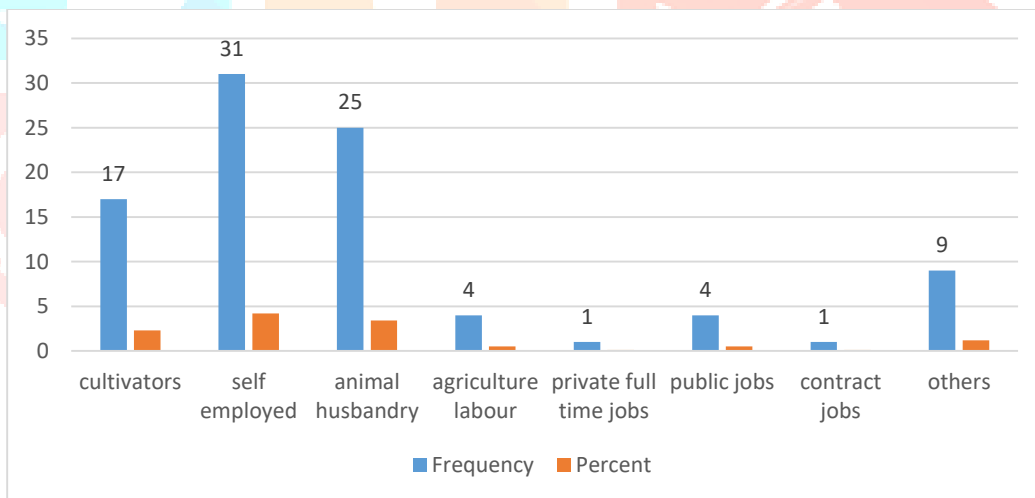


Source: Survey 2021

**Second Subsidiary employment during the sand mining period**

Some sand miners were doing more than one employment activities other than sand mining works such group of activities are coming under secondary subsidiary employment such as cultivators, self-employed, animal husbandry, agriculture, private and public jobs, contract jobs etc. Out of the 738 respondents 92(13%) of them engage in a secondary subsidiary employment activity. Among this 31 of them are doing self-employment such as tailoring, small shops, painting plumbing activities etc. followed by animal husbandry (25) and cultivator’s (17).

Figure: 4 Second Subsidiary employment during the sand mining period

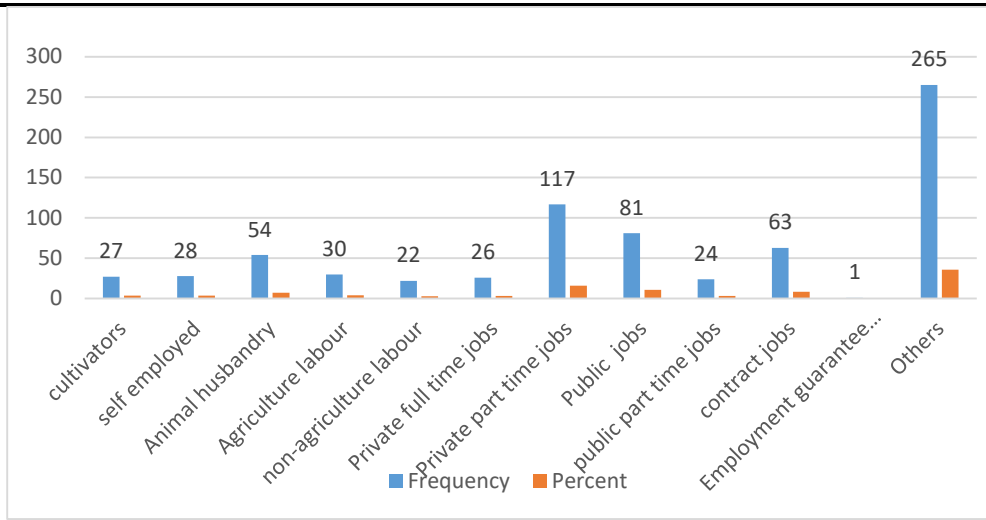


Source: Survey 2021

**Main employment in Post ban Period**

During post ban period of sand mining there is a gradual change in the occupational pattern of sand miners. Their previous subsidiary employment become their main employment, when sand mining banned by the authorities. The main employment activities include cultivators, self-employed, animal husbandry, agriculture labour, non-agriculture labour, private fulltime and part time jobs, public jobs, employment guarantee schemes and others. Among this 265 (36%) of them engage in the other activities such as handicrafts, artworks, pottery making, small scale and cottage industries, non-farm activities such as making baskets, utensils, pots, bricks etc. and of service providers like blacksmiths, nurses, teachers, washer men, weavers, tailors, barbers, cycle repair mechanics etc. In post ban period the respondents prefer flexible time schedule activities like private part time jobs (117) and contract jobs (63) because they want to engage in different income generating activities at time in order to compensate their income lose due to sand mining ban and to maintain previous standard of living.

Figure: 5.Main employment in Post ban Period

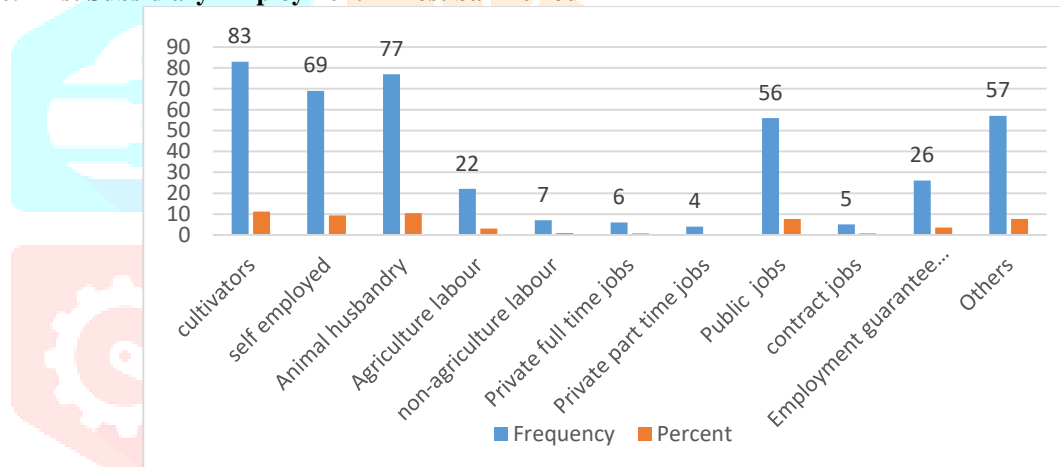


Source: Survey 2021

**First Subsidiary Employment in Post ban Period**

Sand miners forcefully to engage in different kinds of income generating activities due to their loose in income from sand mining. They try to engage in the activities like cultivation, animal husbandry and other service providing activities which requires a small investment. Out of 738 respondents 412 (56%) of them engage in different kinds of subsidiary activities which requires small money investment and more physical man power investment. They find out varied forms of livelihood option which they neglect in the pre ban period.

Figure: 6. First Subsidiary Employment in Post ban Period

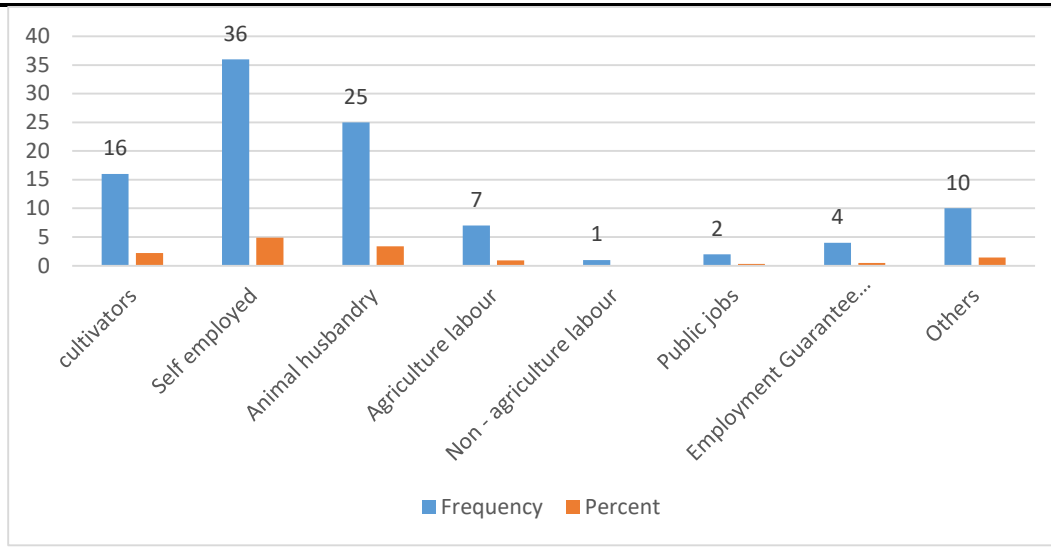


Source: Survey 2021

**Second Subsidiary Employment in Post ban period**

In the case of second subsidiary employment also there is a small increase in the number of people from 92 in the previous period to 101 in the post ban period. Out of 738 respondents (13%) of them were engaged in the second subsidiary employment activities like self-employment (36), animal husbandry (25) and cultivation (16).

Figure: 7. Second Subsidiary Employment in Post ban period



Source: Survey 2021

**Comparison of livelihood Pre and post Ban period**

The comparison of livelihood in the pre and post period indicate that there is drastic transition and diversification of livelihood in the post ban period. During the pre-ban period all of the respondents were engaged sand mining as their main employment. Later, after the ban people started more concentrating on their subsidiary occupation and gradually it become their main employment. This transition was not favourable to all. The transition was favourable to those who had better livelihood assets. For example if a household has an *authoriksha* as their subsidiary occupation while during sand mining period, it become their main occupation when the ban on sand mining was activate. Even though engaging sand mining does not require the hand hold of livelihood assets at least some of them owned as a means of investment for the excess income they created from sand mining. These people could easily cope with and adapt to the stress and shock emerged in the sand mining occupation due to ban on sand mining.

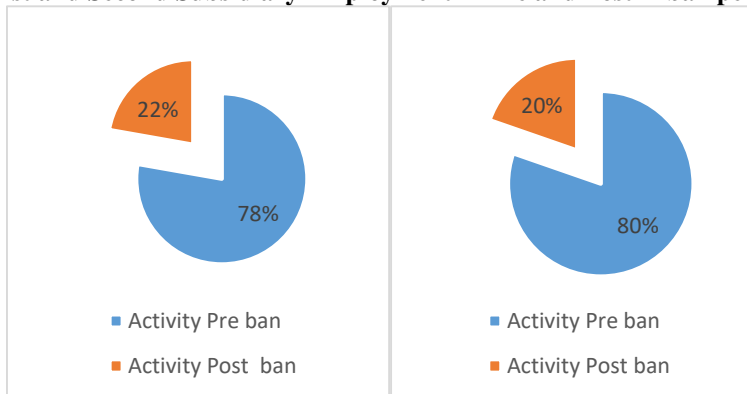
**Livelihood diversification**

Livelihood diversification has been acknowledged as an important strategy applied by vulnerable households to cope and adapt with institutional stresses, environmental and economic shocks. It is a common livelihood strategy for rural households. Diversification is a process by which a household increases the diversity (i.e. number) of its multiple income generating activities. The purpose of diversification is to develop portfolios of income generating activities with low covariate risk among their mechanisms. Livelihood strategy is always associated with divergence of income and assets. The livelihood strategies of poor people are more complex if they have a lower level of capacity to maintain sustainable livelihood with a single source of income without much diversification.

**Comparison of Subsidiary Activities in Pre and Post ban period of Sand mining**

When compare the pre and post ban period employment activities, the fact is that there is a gradual switching from one employment to another. There is a small increase in the number of persons engaged in the first subsidiary employment from 322 in pre ban period to 412 in post ban period and from 92 to 101 in the second subsidiary activity. Reason for this phenomenon is that sand miners have high income to invest in these subsidiary activity during this pre ban period. But in the post ban there is only a small increase in the subsidiary activities because there is a sharp decline in the income of the labourers, so they opted labour induced occupation rather than capital invested employment.

Figure: 8. Comparison of First and Second Subsidiary Employment in Pre and Post ban period of sand mining.



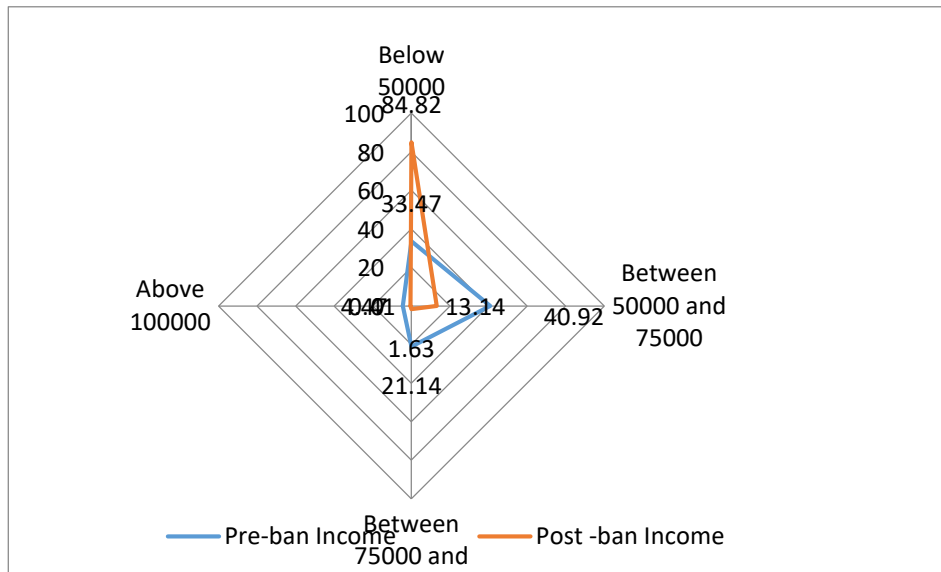
Source: Survey 2021

**Income Pre and Post Ban on Sand mining: Comparison**



While comparing the income in pre- and post-period it is very evident that income in the pre-ban was much higher than the income in the post-ban period. Post income is skewed towards below 50000/- Rupees per month category, while post income more skewed towards income higher than fifty thousand per month. The radar diagram shows a clear cut distinction in the distribution of income across the sand miners in pre and post sand mining period.

**Figure: 9. Income Pre and Post Comparison**



Source: Survey data, 2021

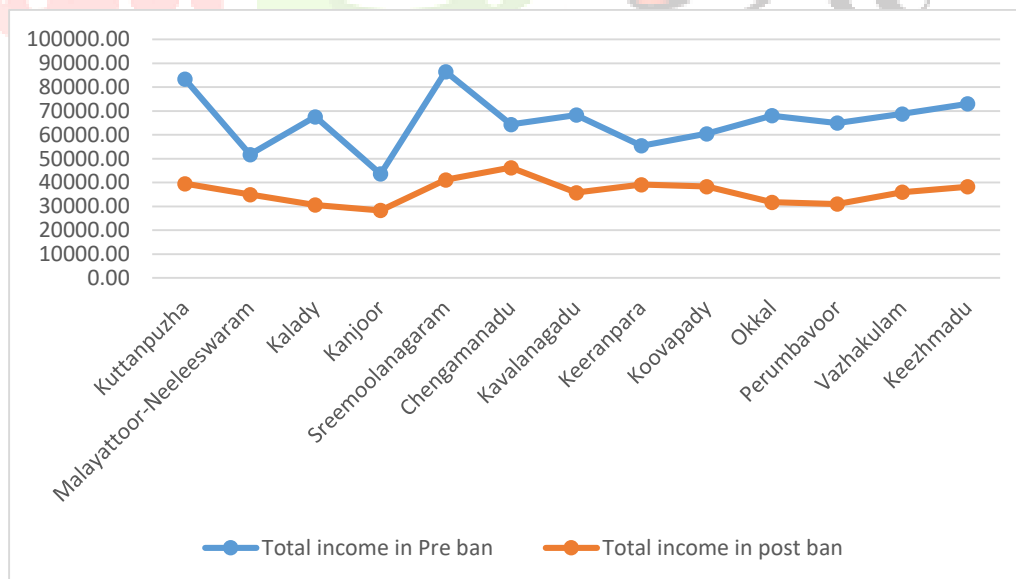
**ANOVA**

One way ANOVA is applied here to compare the mean income of the households across different Panchayats in the pre- and post-sand mining period to understand whether there is significant difference in mean income reported by households in the pre and post sand mining period. ANOVA is applied for total annual income collected from the household from main and subsidiary activities.

**One way ANOVA –Total income**

The total income of the household in the pre and post ban period is plotted in the figure: 12. This shows that in all the Panchayats the total income in the pre ban period is much higher than the post ban period. This indicate that sand mining was an economically viable livelihood option for those who engaged in before the ban on sand mining.

**Figure: 10. Mean Plot-Total Income**



Source: Survey data, 2021

The figure shows that there is a substantial difference in the average annual income across Panchayats. The average income in the pre ban period is higher in Sreemoolanagaram Panchayat and least in Kanjoor Panchayat. The reason for low income in Kanjoor Panchayat as reported by respondent is that the Kadavs in this region is inaccessible. Besides, number of labourers (645) are higher while K (7) are comparatively low. But after the ban on sand mining all panchath had a fall income, but substantial improvement has happed in Sreemoolanagaram and Chengamanadu Grama Panchayats. These results with standard error is reproduced in Table: 1. the table further gives lower and upper bound at 95 percent confidence interval level.

**Table: 1 ANOVA 1 Pre and Post Total income**

Period	Name of Panchayat	N	Mean	SD	Std. Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Total income pre ban	Kuttanpuzha	20	83381.3	16781.07	3752.362	75527.47	91235.03	55000	110125
	Malayattoor-Ne	104	51704.33	17726.5	1738.226	48256.97	55151.69	27500	108500
	Kalady	51	67544.12	20902.38	2926.918	61665.23	73423.01	31250	112500
	Kanjoor	64	43597.66	12976.6	1622.075	40356.2	46839.11	25000	81250
	Sreemoolanagar	56	86513.39	17057.09	2279.349	81945.48	91081.31	62500	140750
	Chengamanadu	20	64318.75	14492.26	3240.567	57536.17	71101.33	37500	98250
	Kavalangadu	50	68330	17965.49	2540.704	63224.26	73435.74	43750	100250
	Keeranpara	13	55394.23	12822.49	3556.319	47645.68	63142.78	37500	89500
	Koovapady	80	60437.5	23658.55	2645.106	55172.55	65702.45	25000	116750
	Okkal	98	68068.88	22972.58	2320.581	63463.17	72674.59	25000	175000
	Perumbavoor	18	64972.22	15902.02	3748.142	57064.33	72880.11	43750	102000
	Vazhakulam	102	68784.31	15061.03	1491.264	65826.05	71742.58	36875	103750
	Keezhmadu	62	72983.87	19418.39	2466.138	68052.52	77915.22	45000	119250
	Total	738	64720.7	21604.05	795.256	63159.46	66281.93	25000	175000
Total income in post ban	Kuttanpuzha	20	39490	17676.21	3952.521	31217.28	47762.72	14625	76500
	Malayattoor-Ne	104	34936.54	14027.1	1375.47	32208.62	37664.46	13125	79500
	Kalady	51	30580.39	10648.97	1491.155	27585.32	33575.46	13125	60000
	Kanjoor	64	28273.83	9716.599	1214.575	25846.69	30700.96	11875	56750
	Sreemoolanagar	56	41129.02	14561.88	1945.913	37229.32	45028.71	15000	75000
	Chengamanadu	20	46227.5	16240.61	3631.511	38626.66	53828.34	20000	77000
	Kavalangadu	50	35736	20504.5	2899.774	29908.69	41563.31	13750	85000
	Keeranpara	13	39138.46	15113.49	4191.727	30005.47	48271.45	20625	66625
	Koovapady	80	38326.25	15259.27	1706.038	34930.47	41722.03	16250	90000
	Okkal	97	31754.9	27911.1	2833.942	26129.57	37380.23	10000	240000
	Perumbavoor	18	30972.22	10170.93	2397.31	25914.34	36030.1	18750	50000
	Vazhakulam	102	35985.29	14147.85	1400.846	33206.39	38764.2	4050	85000
	Keezhmadu	62	38231.45	17723.53	2250.891	33730.52	42732.39	15000	91250
	Total	737	35360.07	17452.36	642.866	34098.01	36622.14	4050	240000

Source: Survey data, 2021

From the ANOVA table given in table: shows that between group and within group variation in pre ban and post ban total annual income is significantly different across different Grama Panchayats. The result are found significant at 5 percent significance level with the F statistics 21.542 for pre ban and 3.418 for post ban period. The between and within group variations are found to be significant at five percent significance level.

Table: ANOVA
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		Sum of Squares	df	Mean Square	F	Sig.
Pre ban total income	Between Groups	90412947483	12	7534412290	21.54	0
	Within Groups	2.53571E+11	725	349752582		
	Total	3.43984E+11	737			
Total income in post ban	Between Groups	12019245527	12	1001603794	3.418	0
	Within Groups	2.12155E+11	724	293032022.2		
	Total	2.24174E+11	736			

Source: Survey data, 2021

### Inferences

The session looks deep into the livelihood aspect of people once engaged in sand mining. The study portrays the livelihood transition and diversification happened to the sand miners. As in every region of the rural Kerala rural village, people were engaged mostly as coolie workers and petty entrepreneurs. When the sand mining introduced they find it economically rewarding as well as convenient for those without any livelihood assets attracted people towards sand mining. The huge demand for sand associated with the construction boom in Kerala induced the demand for land and there by demand for sand miners. The superfluous demand for sand and the rent seeking behaviour of labourers created the institutional failures. This has paved the way for ruthless exploitation of sand and created all sort of illegal sand mining in these region. The living during the time of sand mining for the registered sand miners were luxurious and splendid. They extra income created by the region was reinvested in the same region in indigenous finance and other petty entrepreneurial activities, vehicles etc. Considering the negative impact of excess sand mining when government introduced sand mining ban in Periyar, they are compelled diversify their livelihood across the options available at that time. People with a substantial livelihood assets could able to cope up with the situation very fast. People who had a reliable secondary occupation could able to transform the subsidiary occupation as their main occupation. Others find it very difficult to cope and adapt with the situation. The ANOVA analysis substantiate fact that sand miners had a superfluous during the sand mining period but had less income after the ban on sand mining. This means that people could not cope and adapt fully with the livelihood stress and shocks associated with the ban on sand mining and the livelihood situation in this area is still vulnerable to livelihood.

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Different Registers on sand mining kept in sample Grama Panchayats