THE IMPACT OF COVID - 19 ON HOUSEHOLDS' GEM MINING INDUSTRY: A STUDY BASED ON PELMADULLA DIVISIONAL SECRETARIAT, RATNAPURA DISTRICT

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Abstract

The study examines to identify the impacts of COVID-19 on the household gem mining industry. In order to obtain the objective of socio-economic effect on household income, this study used household income as dependent variable and education, monthly consumption cost and number of family member as independents variables. Pelmadulla divisional secretariat. The primary data were collected through structured questionnaires, focus group discussions and interviews by the cluster sampling method. M S Excel and SPSS -26 software were used for descriptive and multiple regression analysis. This study found few impacts through descriptive analysis, such as saving decreasing, fewer working days, and health issues quite high due to the lockdown and travel restrictions. Moreover, this study revealed that education and the number of family members have had positive impacts, while monthly consumption costs have had a negative impact on the income level of households. Thus, negative and positive relations between variables lead to promoting the socio-economic status of the household gem mining industry. Hence, this research draws up a few recommendations to improve the socio-economic status of the household. The government should consider the gem mining field and also take the proper policy for those workers to overcome such a situation in the future.

Keywords: *consumption, gem mining, health diseases, household & socio-economics*

1. Introduction

COVID-19 was firstly found at Wuhan, China in December 2019. It was spread all over the world since first half months of 2020. Then the world health organization declared it "worldwide pandemic". This pandemic affected almost all the country in the world. Sri Lanka is one among them. Sri Lanka followed various ways such as curfew, lockdown and travel restriction due to the COVID-19. These activities affected the domestic economy negatively. A lot of economic sectors affected badly. The gem-mining sector is also one among them (Cental Bank, 2019). Sri Lanka gem earns the prime foreign exchange among minerals. Pelmadulla DS Division in Ratnapura district is internationally famous for gem mining. Gems give significant part for the national income for our country. Since, ancient kingdom gem had been taken place a commercial stuff. Gem mining can be seen in various parts of Ratnapura District. This industry

proceeds in 3 categories. Such as, Traditional mining by the use of human, illegal gem mining along the river bed, Machine mining by the use of loader (Auditor General's Department, 2013).

Sri Lanka is the ideal gem mining country compare with other countries because of its environmental nature. Gem mines can be seen throughout Sri Lanka. There are Elehara gem fields (near Ratnapura), Metiyagoda moonstone mines (South- West Coastal), Morawaka (South- Central), Nuwara Eliya mines (mountains tea plantation area), and Pelmadulla sapphire mines (15km South East of Ratnapura). (Gem gravel, Ratnapura, Ratnapura district, Sabragamuwa province). Historical evidence shows that Greeks, Arabians, Romanians had bought gem for commercial purpose. Therefor Sri Lanka called by a name "Ratnadeepa". Minerals provide 3% in export to Sri Lanka. In 2008, 2017 Sri Lanka exported 8,096.2million, 22075.6million respectively. During 2008- 2017 gem was the most earned foreign exchange. (Larif,, 2008)

Pelmadulla Prehistoric era: Prehistoric research in Sri Lanka has been a major advancement since 1942 by Professor P.E. P. Deraniyagala's interference. He focused his attention on the areas around Ratnapura and found a prehistoric fossil in a gem mine in the Pelmadulla area. From the Bulatwaththa, tools belonging to the Balangoda culture have been discovered. Anuradhapura Era-According to the "BODHIWANSHA", there was a plant of Sri Maha Bodhi which is called "this phala ruha bodhi" which had been planted in Ganegama, Polonnaruwa Era-During the reign of King Vijayabahu I. He is said to have kept a camp between the Kiribathgala and Kuttapitiya Mountains in Kehelbaddala and Denawaka.This place, where the basin is curved, was named " Dronawakra". after "Dronawakra" was renamed "Denawaka."Kotte Era- King Parakramabahu VI built temples in the country. When he immersed himself, he sacrificed a vihara at Ganegama Viharaya, sacred to Sunethra Devi. The female population outnumbers the male population in the Pelmadulla DS division, which has a total population of 102743.There are 52,630 females and 50113 males in the city.The Pelmadulla DS division is home to three major ethnic groups.Sinhalese are the majority. Tamils and Muslims are in the minority. There are 23344 Sinhalese, 3353 Tamils, and 147 Muslims. Higher percentages of the population get 10000 to 20000 income levels. The Pelmadulla DS division has the lowest population with an income of $1,000.Most people live in their own homes, 23301; the least number of people live in rented houses (Divisional Secretariat, 2020).

Sri Lanka earned 48 million American dollars in the first half of 2019 by itself. Worldwide, Sri Lanka takes 5th place after Brazil, Burma, Thailand, and South Africa. Next to Brazil, Sri Lanka produces more than 50% of the varieties of gems. Sri Lanka contributes 25% of the gem world trade market. The current value of it is $350 million per annum.

Objectives

The main objective of this study is to examine impact of COVID-19 on households' gem mining industry in Pelmadulla DS Division. Furthermore, the sub objectives are;

➢ To identify socio-economic effect of the households.
➢ To analyze the Social impacts of households of gem mining industry

➢ To identify Economic impacts of households' income in gem mining industry.

2. Literature Reviews

Muthuri, Jain and Ndgewa (2021) the study examines the impact of COVID-19 on gold and gemstone artisanal and small scale mining practices in Sub-Saharan Africa and the economic and social impacts of the COVID-19 pandemic on gold and gemstone artisanal small scale mining in both countries. The study based on primary and secondary data. Interviews with 29 mining stakeholders in Ghana and Kenya. The studies recommend the key policy challenges and suggest actions that can help mitigate the negative impacts the pandemic has had on artisanal small mining.

Rachel perks et al. (2021) COVID-19 in artisanal and small scale mining communities. Preliminary results from a global rapid data collection exercise. As early as March 2020, anecdotal reports and some new stories began trickling in about COVID-19 related restriction and their impacts on strategic minerals supply chains and the miners who labor in the informal mining sector. However, these reports were few and far between. Imperative was the for a more accurate and comprehensive picture of the situation, should development partners wish to respond rapidly and accurately to the possible crisis developing in artisanal and small scale mining. The World Bank, along with a range of development partners, set out to understand how COVID-19 is in fluency the development trajectories of select ASM communities by way of standardized short questionnaire administrated by telephone, researcher conducted rapid surveys with miners in ASM communities spread across 22 countries and mining a total of nine minerals. The results, as discussed in the viewpoint piece suggest that whilst ASM communities to offer important livelihoods, even amidst crisis such as COVID-19 the sector is yet to be fully integrated into sustainable development discussion.

Mieke Thierens et al. (2020) set up as a small qualitative scoping study this IPIS insight aims to highlight key elements of the socio economic impact of COVID-19 measures and restrictions on artisanal mining communities in northern. Tanzania as observed by selected members of these mining communities. Phone based interviews were conducted with 37 key information. Informants were questioned on the implementation of preventive measures at mining sites the impact of COVID-19 on mineral production prices and the impact of large on mining communities in northern Tanzania.

Santhirakumar et al (2020) this author highlighted that the outbreak of coronavirus disease-2019 (COVID-19) has severely affected national and global economies. Various MSMEs are facing different issues with a certain degree of losses during the COVID-19 pandemic period. Therefore, the main objective of this study was to identify the major economic impacts on MSMEs through the marketing mix concept (4Ps) method and found that impact on the market (338 out of 400), and reduction of customer communication (340 out of 400) were first ranked in production, price, place, and promotion respectively during the pandemic period the study recommended, the NGOs and local government bodies should create awareness and support to the MSMEs.

Wickramanayaka (2020) the study analyze that the problems faced by small scale gem miners. The purpose of this study was to study the problems faced by small scale gem miners today. The factors that make small scale gem mining profitable endeavor. Quantitative and qualitative methods were used for gathering information. The study was based on primary data. Analysis methods using structured questionnaire. The research found that particle knowledge, financial assistance, marketing can be proposed by informing the younger generation about the value of small scale gem mining.

Darsha and Amarasingha (2019) this study is a contribution of gem industry on regional development a case study Ratnapura divisional secretariat in Ratnapura district. The objective of this study is to evaluate the contribution of the gem industry in the development of the Ratnapura divisional secretariat division. Field data were collected from the Ketaliyanpalla and Angammana GNDs area to make decision on this data the relevant books and records published were referred. Data analyzed with GIS data and excel. The results of the study are presented in reports charts and maps. The research found that the gem industry has contributed to the employment generation and income generation of local development. Therefore, the contribution of the gem industry to the development of the area should be increased. Also the workers in the gem industry need to be provided with proper training and the use of income saving to improve the economic status of the gem industry.
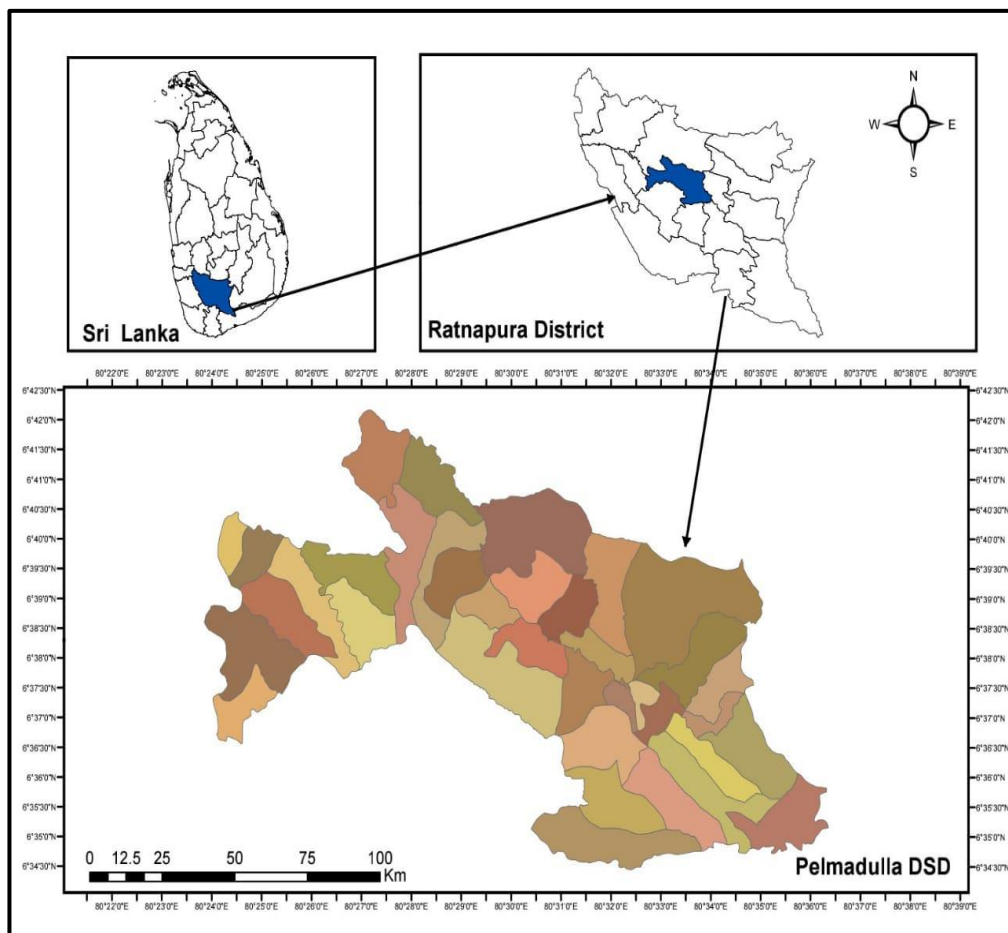
Source: Computer using Arc GIS 10.3, 2022

Thus, there are many national and international studies on the gem mining production. There were various studies had taken place island wide about gem mining. But this study identifies gap in the impact of COVID-19 on gem mining production and the impact of its on households' income.

3. Methodology

The primary data were conducted polite survey and collected through structured questionnaire survey, focus group discussion with 6 households from November - 2021 to May - 2022. Moreover secondary data collected the published and unpublished sources from Pelmadulla DS Division. The study area is Pelmadulla division including 36 Grama Niladhari Division to select sample. According to that cluster sampling method has been used for the study to choose samples of household engage in gem mining industry based on random sampling selection, following equation has been employed. According to the sample there are 6 grama niladhari selected by researcher.

$$\text{Proportion of household} = \frac{\text{number of household involving in gem mining}}{\text{Total number of household involving in gem mining}} * 100$$

$$\text{Sample} = \frac{\text{Proportion of household}}{100} * \text{number of household involving in gem mining}$$

Table No: 1.1: Sample size

Names of GN	No of household	Pro. Of Sample	No of Sample	Total Sample
Hakamuwa	100	100/696*100 14.36	14.36/100*100 14.36	**14**
Panawenna	105	105/696*100 15.08	15.08/100*105 15.83	**16**
Borala	103	103/696*100 14.79	14.79/100*103 15.23	**15**
Rilhena	170	170/696*100 24.42	24.42/100*170 41.51	**42**
Kattange	92	92/696*100 13.21	13.21/100*92 12.15	**12**
Ganegama	126	126/696*100 18.10	18.10/100*126 22.80	**23**
	696			**122**

The descriptive analysis is explained through the graphs, and the economic analysis is explained through the multiple regression analysis. The analysis shows the economic impacts on the household gem mining industry through the multiple regression model. This section analyses the sub-objective of this study. It identifies the factors of multiple regression analysis that impact on income level. The study was conducted with both descriptive analysis and regression analysis in order to achieve the objectives. Mixed methods for analysis, qualitative and quantitative, for descriptive analysis The regression model is used to explain the objectives of the present study. Based on the research area, more suitable variables were considered. Based on that, to find out the relationship between the variables will be following the regression model.

Multiple regression model: $Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + U_i$

Y_i = Income

$x_{1=}$ Education(ED)

x_2 = Monthly consumption cost(MCC)

x_3 = Numbers of family members(FM)

U_i = Error Term

The hypothesizes are tested with hi-square and Pearson correlation with multiple regression model.

H$_0$: Independent variables are not affect dependent variable

H$_1$: Independent variables are affect dependent variable

4. Results and Discussion

The Analysis Socio-economic impacts on household gem mining industry through the Descriptive and multiple regression model

Figure 4. 1: Age group and dependents of the Households
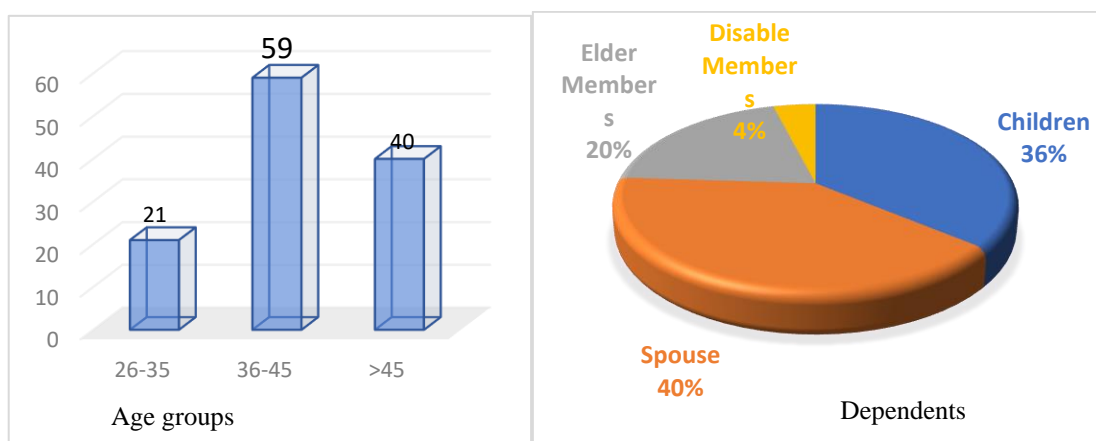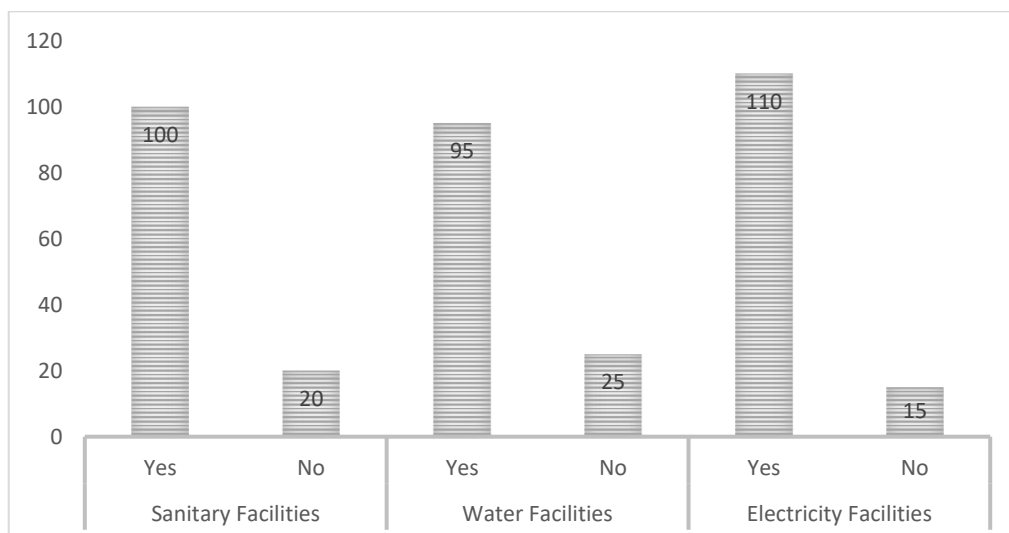

Source: Estimated data, 2022

According to the figure No 4.1 the age group, who are involving in gem mining, there are of 21 participations between age group of 26 - 35, there are 59 respondents of age group Between 36 – 45, 40 respondents age group of above 45. So, most of the gem mining household's ages Between 36 – 45 and less mount of households ages Between 26 - 35 in this particular research. Moreover, the pie chart shows the results of survey there are 40% of spouses are dependents, 36% children are dependents, there are 20% elder members dependents and there are 4% of disable members dependents in the research area. Through the focus group discussion, the respondents said that the most of the spouse are unemployed and some respondent's spouses are employed in this research area.

According to this study figure no 4.2 bar chart shows that most of the respondents its mean 100 of households have sanitary facilities 20 of respondents have not sanitary facility. 95 of households have water facilities and 25 of household have not sanitary facilities.110 household have electricity facilities and there are 15 household have not electricity facilities. In this data the higher numbers of households have water, sanitary and electricity facilities, least numbers of households haven't water, electricity and sanitary facilities.

During the focus group discussion, the households highlighted particular facilities they requested to the government to provide their basic facilities during the pandemic they suffer for their sanitary facilities in this survey.
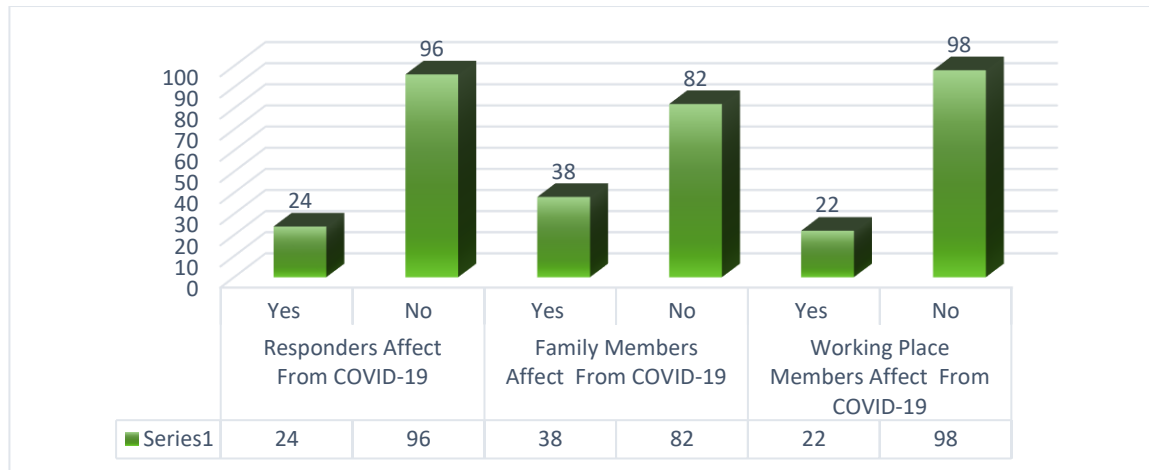
Figure 4.2: Sanitary, Water and Electricity facilities of households
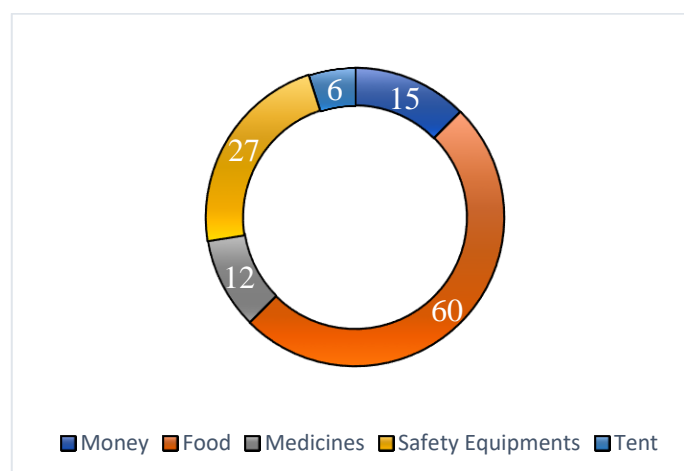

Source: Estimated data, 2022

Figure 4.3: Amount of respondents and related people affect by COVID-19

	Yes	No	Yes	No	Yes	No
Responders Affect From COVID-19						
Family Members Affect From COVID-19						
Working Place Members Affect From COVID-19						
Series1	24	96	38	82	22	98

Source: Estimated data, 2022

According to the figure 4.3 bar chart shows that amount of respondents and related people affect by COVID – 19. There are 24 of respondents have affect from COVID-19, 96 households haven't affect from COVID – 19 involving in gem mining. 38 respondents' family members affect from COVID – 19. 82 respondents' family members haven't affect from COVID – 19. 22 respondents working place members have affect from COVID -19. 98 households working place members haven't affect from COVID – 19. Some household's family members and working place members are died affect from COVID – 19.

**Figure 4.4: Received External Assistance in COVID-19 period**

Source: Estimated data, 2022

The above figure No: 4.4 illustrates that there are 120 respondents got external assistance from owners, governments and family members. The external assistances are money, food, tent, medicines, safety equipments.15 respondents got money during the pandemic from the owners and government to fulfill their basic needs. 27 respondents got safety equipment's like mask, glows and sanitizer. 6 respondents got tent in the working places during the pandemic because lockdown and travel restriction.12 of respondents got medicines and 60 respondents got foods like rice, vegetables during the pandemic period they said through the focus group discussion these external assistances useful for them in this research area.

**Figure 4.5: Supports from government during COVID -19 period**
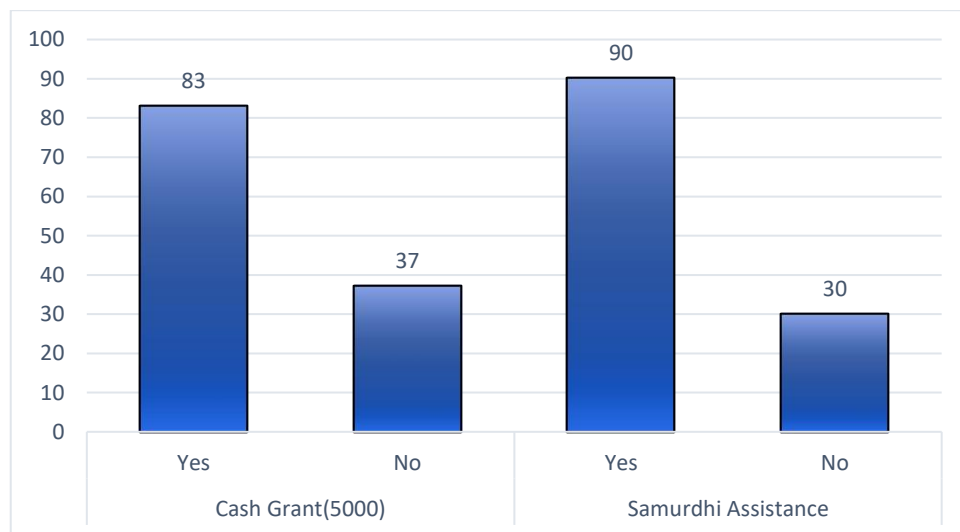
Source: Estimated data, 2022

According to figure no 4.5 the bar chart 120 respondents got supports from government like cash grant of 5000 rupees and Samurdhi assistance. 83 respondents got 5000 rupees of cash grant. 37 respondents have not got 5000 rupees of cash grant. 90 respondents got Samurdhi assistance.30 of respondents have not got Samurdhi assistance during pandemic period through the focus group discussion the household said that request to government to increase the Samurdhi assistance. This assistance helpful them to fulfill their basic needs to them and their family members in this survey.

Figure 4.6: Identified Health Issues households during COVID-19 period
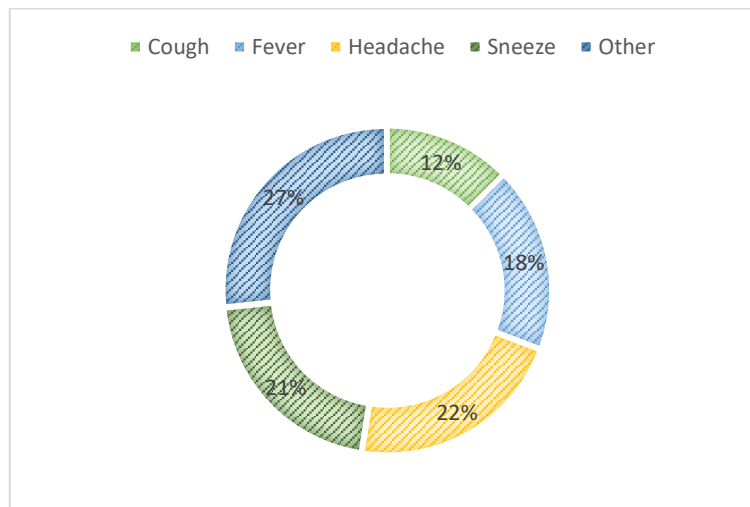
Source: Estimated data, 2022

The above chart, figure No. 4.6 chart shows that 120 respondents responded to the survey. identified health issues during the pandemic period among households who were involved in gem mining. Identified health issues are cough, fever, headache, sneezing and other issues. 22% of respondents had headaches. 21% of households had a sneeze. There are 27% of other health issues. 18 % respondents suffered from fever and 12% of respondents had cough in the research area during the pandemic in this research area. The focus group discussion was done by selecting 10 households. Some people lived in rented houses, making it difficult for them to pay rent during the COVID-19 period.Due to the lack of pure drinking water facilities in the research area, people in this study field have to travel a long distance in order to fulfill their drinking water-related facilities. During the COVID-19 period, the government provided the people with 5000/= payments and assistance for people getting Samurdhi. They said that this assistance reduces little pressure related to their consumption of people in the group discussion.

Further, the household is unable to engage in other employment beyond gem mining for their livelihood during COVID-19 (lockdown) because of the obstacles to earning income. They also didn't get any support from the government or owners for the alternative through the group discussion, the household said. During the pandemic, there was a decrease in working days due to the lock down and travel restrictions.

➢ The Analysis of Economic Impacts on the Household Gem Mining Industry through Multiple Regression

This section analyses the sub-objective of this study. Based on the research area, more suitable variables were considered. Based on that, to find out the relationship between the variables will be following the regression model. It identifies the factors of multiple regression analysis that impact on income level. The data have been analyzed using SPSS 26 software. Multiple regression models include Linear-Linear, Log-

Linear, Linear-Log, and Log-Log. Dependent variables and independent variables were used in this regression for the analysis. The income of the household was considered as a dependent variable in the study, and education, monthly consumption cost, and number of family members were considered as the independent variables. The first differential method was used to get the best model among the models.

The regression model of this study is as follows:

$$Y_i = \beta_0 + \beta_1 x_1 (ED) + \beta_2 x_2 (MCC) + \beta_3 x_3 (FM) + U_i$$

Table 4 1: Selecting suitable regression model

Models	R^2	Adj.R^2	"F" Value	"P" Value	DW	VIF
Linear-Linear $Y_i = \beta_0 + (Ed)i + \beta_2(MCC)i + \beta_3(FM)i + U_i$	77%	76%	132.819	0.000*	1.31	2.1-6.7
Log-Linear $Y_i = \beta_{0+}(Ed)i + \beta_2(MCC)i + \beta_3(FM)i + U_i$	**94%**	**93%**	**624.143**	**0.000***	**2.483**	**2.1- 6.7**
Linear- Log $Y_i = \beta_0 + (Ed)i + \beta_2(MCC)i + \beta_3(FM)i + U_i$	86%	85%	204.895	0.000*	1.157	3.2-10.3
Log-Log $Y_i = \beta_0 + (Ed)i + \beta_2(MCC)i + \beta_3(FM)i + U_i$	87%	86%	1	0.000*	1.204	3.3-6.3

Source: Estimated by the Researcher, 2022

(DL=1.461<DW>DU = 1.604)

1%*level of significant

To analyze the relationship between income level of Household and following variables which are close relationship between the incomes levels, there are following linear-linear, log-linear, linear-log, and log-log and log linear model have been used in the study. Beast model was selected based on the various model selection statistics which was shown in the above model. Based on the table 1.1, Adjusted R^2 is higher in Log-Linear model is 94%. At the same time R^2 higher than Log-Linear model at 60%. According to the $R^{2,}$ independent variables are significant impact on income level of Household.

The 'F' value is higher as 624.143 in log linear and VIF value range is Between 2.1 - 6.7. So, there is no Multi-Colinearity problem in the Log –Linear model. Based on the Durbin – Watson "d" statistics, D.W value has existed within the No decision area in both 1% significant level (DL=1.461<DW< 1.604) at 1% significant level. In addition, based on the above models probability value of F statistics also significant at 1% of Log – Linear model. In addition, based on the above models probability value of F statistics is also significant at 1% in the Log – Linear model. So, the Log – Linear model has been considered for the study.

Table 4.2: Results of Log-Linear model

Variables	Co-efficient	" t " Value	Probability value	VIF
Constant	-462.095	-0.368	0.714	
Monthly consumption cost	-1.352	-2.569	0.011**	4.614
Education	2.400	6.742	0.000*	6.763
Numbers of family members	2.176	35.424	0.000*	2.112

Source: Estimated by the Researcher, 2022

(DL=1.461<DW>DU=1.604)

1%* level of significant

5% **level of significant

According to the regression result above, table no. 1.2 shows that, value of R^2 is 94%. So, explanatory variables contribute 60% to determining the dependent variable. In addition, the model is accepted because the probability value of the F statistics is significant at 1%.

Moreover, based on the table, it can explain the independent variables, education, monthly consumption cost, and number of family members, used to determine the income level of household. Based on the results, the regression will be as follows to discern the impact of Education, Monthly Consumption Cost, and Numbers of family members on the income level of household.

$$\ln Y_i = -4.62.095 + 2.400(ED) - 1.353(MCC) + 2.176(FM) + U_i$$

According to table no 1.2, the probability value of the rapport between income and monthly consumption cost is 0.011 and the parameter is -1.352. So, monthly consumption costs significantly impact the income level of a household and reveal a negative relationship; namely, when monthly consumption costs are increased by 1%, income will decrease by -1.352%. Moreover, the T statistic probability value of the rapport between income and education is 0.011, meaning that education significantly impacts income at a 1% significant level. And there is a positive relationship between education and income because the parameter of education is 2.400. Therefore, education will increase by 1 unit and income will increase by 2.400%. The T statistics probability value of the relationship between income and education is 0.0001. So education significantly impacts income at a 1% level. The model shows that with every increase of one person in a household, the income level of the household increases by 2.176%.

According to the above results, education and the number of family members have a positive impact on the income level of a household in the research area. Monthly consumption costs have a negative impact on the income level of a household during the COVID-19 period. When increased by one unit of education level, number of family members, and monthly consumption cost, then the income level of the household rises by 2.400, 2.176, and -1.352 units, respectively. So, there is a positive and negative relationship between the income level of household gem mining and other independent variables.

Hence, there is a positive and negative relationship between the income level of household gem mining and other independent variables. In the results, economic indicators affect the households' gem mining. So, hypothesis H1 is accepted.

Education & Income: During the COVID-19 Period, education service was enhanced. So, many people at the time considered this online education platform to be a way to earn income that was disrupted due to the health crisis. For example, private classes, online education. Through the focus group discussion, the family said that their children were suffering from coverage issues. Some areas they haven't covered. There was a rise in the cost of data cards for online classes, and some households said that their children went to private classes during the pandemic.

Consumption & Income: During COVID-19, the demand for monthly requirements by people started to spend their holdings, which ultimately led to a decline in income. For example, during the COVID-19 period, people purchase essential goods and safety measures like herbs because at that pandemic time, the income is low and they purchase for their own purposes. Through the focus group discussion, the household said that during the pandemic, high levels of costs were incurred to spend their monthly consumption. like food, medicine, and some essential goods. But the household's working days are at a low level. The gem mining household faced unemployment and multidimensional poverty. They don't have any other income-earning sources. So, they suffer to earn income during the pandemic, which is not enough for their monthly consumption.

Family members & Income: Due to widespread of COVID-19 at the beginning in the country. due to foreign workers' return to the country. At that time, income will increase. During the COVID-19 pandemic, the people isolated at the quarantine centers will be affected byCOVID-19,9 so during that time period, people's income will increase. Through the focus group discussion, households said that, their family members were affected by COVID-19. So, their family members are isolated at home and in quarantine centers. Some households' family members return to the country during the pandemic period.

Conclusion

The results of social impacts on sanitary, water, and electricity facilities; health issues of households; and COVID-19-related factors through the descriptive analysis. It is difficult for people to pay rent and travel a long distance in order to fulfill their drinking water-related facilities. Through the focus group discussion, 5000/= payments and Samurdhi that assistance reduces little pressure related to their consumption of people, obstacles in earning income, and working days.The value of R^2 is 94%. So, explanatory variables contribute 60% to determining the dependent variable. R2 greater than 60% in the model is a Log-Linear (94%) model. Based on the Log-Linear model, only the significant variables are significant. So the researcher considers the Log-Linear model as the one which is both the accepted model and the best model. In addition, the model is accepted because the probability value of the F statistics is significant at 1%. Moreover, based on the table, the independent variables, education, monthly consumption cost, and number of family members, are used to determine the income level of the household. The regression will be as follows based on the results to determine the impact of education, monthly consumption cost, and number of family members on the income level of the household.When the education level is increased by one unit, the number of family members, monthly consumption cost, and income level of the household increase by 2.400, 2.176, and -1.352 units, respectively.So, there is a positive and negative relationship between the income level of household gem mining and other independent variables.

According to the above results, education, number of family members and household income level have a positive impact on the income level of households in the research area. Monthly consumption costs have a negative impact on the income level of households during the COVID-19 period. In the results, economic indicators affect the households' gem mining. So, hypothesis H1 is accepted. The negative and positive

relations between variables lead to promoting the socio-economic status of the household gem mining industry. This research draws up a few recommendations to improve the socio-economic status of the household. The government should consider the gem mining field and the government should have taken the proper policy for gem mining workers.

Recommendations

Provide a subsidy to gem mining households. Through the focus group discussion, the household said that they would increase their cash grant to 5000/= and Samadhi assistance. because their income was at a low level during the pandemic to fulfill their income. The government should have a proper policy to reduce multidimensional poverty for gem mining households. Through the focus group discussion, some households said that their basic facilities were not fulfilled by the government. As a result, the government should provide basic facilities for gem mining households and encourage self-employment opportunities for gem mining households.Because the households struggled to meet their basic needs such as food, medicine, and working days, they had fewer days and income to spend during the period.The government should provide guidelines for the households' use of gem mining during the COVID-19 pandemic. It provides insurance, safety measures to the household during a pandemic like sanitation. Masks, Glows Also, during travel restrictions and lockdown, the owners should provide tent facilities to stay at the working places.

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