Socioeconomic Factors Responsible for Livelihood Improvement of Agar (Aquilaria malaccensis. roxb) Oil Producers of Maulvibazar District, Bangladesh

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Authors’ contributions
This research work was carried out in the proper collaboration among all authors. Author BM designed, collected, analysed and checked the data; and prepared the draft manuscript. Authors JUA and KF jointly supervised the thesis, coordinated, reviewed; and approved the final manuscript. Author MNM managed the literature searches and data interpretation. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study was accomplished for assessing the impact of agar oil production on livelihood improvement of its producers.

Study Design: This article is a socioeconomic study and placed on empirical analysis. It conducted the socioeconomic factors which had an impact on the livelihood improvement of agar oil producers.

Place and Duration of Study: The study was conducted at Barlekha Upazilla of Maulvibazar District of Bangladesh. The study period was mid-June to mid-September/2017.

Methodology: The relevant data were collected from the agar oil producers of Maulvibazar District, Bangladesh. Household having at least one factory were included for the study. A total of 60 households among 180 household were selected as sample. Field survey data were collected through face to face interviewing of the respondents using a structured questionnaire through simple random sampling. After cleaning and correcting the data Microsoft Excel and Statistical Package for Social Science (SPSS) were used for analyzing the data.

Results: The average family size was found 10.17 (small: 10%; medium: 45% and large: 45%) and majority (63.3%) belongs to the graduation level, meaning having 16.0 years of education. The
results of the regression model revealed that amount of annual income, credit access of household, membership of an organization had the positive impact and an increasing the age of household head had a negative effect on livelihood improvement. Instead of having different constraints, the major problems faced by the producers in agar oil production were lack of industrial gas connection and lack of modern laboratory.

**Conclusion:** In order to enrich the livelihood improvement of agar oil producer’s industrial gas connection, modern laboratory and better credit services should be well executed by different government and non-government organization.

**Keywords:** Socioeconomic; agar oil; livelihood improvement; factors; Maulvibazar; Bangladesh.

### 1. INTRODUCTION

The agarwood is known with different names in different parts of the world such as Aloe wood in Indonesia, Malaysia, and Papua New Guinea as Gaharu, in Japan as Jin-koh, in China as Chen Hsiang or Chen Xiang, in Korea as Chim-Hyung and Oud and so on [1]. Agarwood is a resinous part of Aquilaria tree which is formed in response to biotic and abiotic stress [2]. It is a fragrant wood that has been traded for a long time for its use in religious, medicinal and aromatic preparation. The essential oil is derived from the heartwood of the agarwood tree [3]. The establishment of forest species producing agarwood is gaining attention at national and local levels as the resources from the natural forest are depleting over the years [4]. The production of agarwood is uncertain and it is estimated that only 10% of the Aquilaria trees in the forest may contain agarwood [5]. Having different species like Aquilaria agallocha or Aquilaria crassna, Aquilaria malaccensis, roxb are very much popular species which are used to make the oil. There are many grades of agarwood oil. The quality of grade is mostly dependent on the grade of wood which is used in making oil and the length of distillation. Typically, the longer the distillation time the higher the grade [6]. Most agarwood oil is purchased and consumed primarily by Saudi Arabia and Japan [7]. Multi-dimensional uses of agar oil may be described as Arabian perfumes (oil-based) and French-style perfumes as the body fragrance. International market demand and price of agar oil is very high. The trading value of pure agar oil is $30,000 to $40,000 per liter or Tk. 2,534,400 to Tk. 3,379,200 per liter in Bangladeshi currency [8]. The development of this sector depends on a sustainable source of raw materials, availability of technical and financial assistance and opportunity for expansion of market facilities to secure the maximum benefit achievable from this highly promising industry. It is evident that rural households in Bangladesh engage in multiple livelihood activities such as trading (marketing or adding value to commodities), small-scale business enterprises (carpentry, radio and bicycle repairs), and processing of agricultural goods and arts and craft (weaving, mats and basket making) in order to supplement earnings from agriculture [9]. The livelihood comprises the capabilities, asset including both material and physical resources, and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future [10]. Hence it is the way by which people make their living and pay for the basic things they need in life [11]. In addition to various Asian countries, agarwood has a long history in Bangladesh, especially in Maulvibazar and nearby districts [8]. Sujanagar village of Barleka Upazila is famous for producing incense and attar (the essence of flowers and agar tree) in Bangladesh and has a multi-dimensional effect on its producer’s livelihood [12]. Agarwood oil has found lucrative markets in Middle Eastern and Far Eastern countries for over a century. There are about 350-400 agar attar factories in Barleka Upazilla and is considered as the liquid gold of Bangladesh [13]. Jha [14] conducted a research on agarwood plantation and products as livelihood strategy from Ban Khlong Sai village, Northeast Thailand. The analysis found that agarwood products were important to earn a high income by virtue of being expensive and therefore, many villagers (38%) were attracted to this for livelihood activity whereas the income earn from different agricultural crops was very low as compared to agarwood. Shahidullah and Haque [15] conducted a study on linking medicinal plant production with livelihood enhancement in Bangladesh: implications for a vertically integrated value chain. The result implied that 53% of the respondents agreed that their livelihoods improved with income generated from medicinal plant cultivation with the profit margin at the middleman level ranged from 59%
to 139% and at the wholesale level it was 22% to 90%, as opposed to the cost of goods sold by the middlemen and wholesalers, respectively. However, little research has been conducted on garwood production and socioeconomic aspect of its producer. The study will identify the socioeconomic profile and determinants of livelihood improvement of the agar oil producers. To enhancing the livelihood improvement of agar oil producer in Barlekha Upazila of Maulvibazar District the specific objectives are carried out:

i. To document the socioeconomic characteristics of the selected agar oil producers;
ii. To identify the factors responsible for livelihood improvement of agar oil producers; and
iii. To explore the possible constraints and provide some policy recommendation.

2. MATERIALS AND METHODS

2.1 Selection of the Study Area and Sample

The study was conducted at Maulvibazar District of Barlekha Upazilla covering three villages namely Sujanagar, DakshinBhag, and Cintapur of Bangladesh lies between latitude 24°40´N to 24°50´N and longitude 92°05´E to 92°15´E [16]. For the investigation, simple random sampling and stratified technique were applied for socioeconomic and livelihood aspect of the oil producers through the direct interview during Mid June to Mid September/2017. A total of 60 samples of agar oil producers were included in this study.

2.2 Data Sources

To carry out the present study, primary data were collected from the respondents by face to face interview with the help of interview schedule designed for the study. Most of the respondents did not keep any written records of their factory activities. So, the researcher mostly has to be depended upon the memories of the respondents. As a consequence, it was very difficult to collect actual and correct data from the respective respondents. The unit was given to the local standards. During tabulating, it was converted into the international standard unit. Apart from these primary data, some relevant secondary data were also collected from secondary sources such as government report, numerous publications journal, thesis and so on.

2.3 Methods of Data Analysis

Descriptive statistics was extensively conducted by designing a list of tables with respect to the objectives of the study. The calculation procedure of the entire technique was based on weighted average and percentages and to describe socioeconomic characteristics of agar oil producers.

2.4 Functional Analysis

To determine the factors responsible for livelihood improvement, the logistic regression model was used [17]. This method was chosen because it is a standard method of analysis when outcomes variable is dichotomous and when the improvement in livelihood is measured as a dichotomous variable having a value 0 or 1, where 1 = Improvement in livelihood due to change in income and 0 = Otherwise. A Logit model was used:

\[ Y_i = \ln \left( \frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \epsilon_i \]

Here,

- \( P_i = \) Probability of improvement and non-improvement in livelihood
- \( P_i = 1 \) indicate improvement and \( P_i = 0 \) indicate otherwise
- \( Y_i = 1 \) indicate improvement in livelihood due to change in income and \( Y_i = 0 \) indicate otherwise

Where,

- \( \beta_0 = \) Intercept
- \( X_1 = \) Age of household head (years)
- \( X_2 = \) Family size (no.)
- \( X_3 = \) Level of education (years of schooling)
- \( X_4 = \) Occupational experience (years)
- \( X_5 = \) Annual income (Tk.)
- \( X_6 = \) Credit access (Tk.)
- \( X_7 = \) Savings (Tk.)
- \( X_8 = \) Membership in an organization
- \( X_9 = \) Relative in abroad
- \( \epsilon_i = \) Error term

2.5 Constraint Facing Index (CFI)

To explore the problems faced by the agar oil producers constraint facing index was used [18]. The following formula was,
CFI = (C_h × 3) + (C_m × 2) + (C_l × 3) + (C_n × 0)

Where,

CFI = Constraint Facing Index;

C_h = Percentage of respondents having high constraints;

C_m = Percentage of respondents having medium constraints;

C_l = Percentage of respondents having low constraints; and

C_n = Percentage of respondents having no constraints.

An attempt has been made to find out suggestions from the respondents to overcome the identified constraints.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of the Respondents

The demographic information of the producers is represented in Table 1. It is seen that the average family size of the respondent was 10.17 (whereas small: 10%; medium: 45% and large: 45%). Because they lived with their parents, brothers, relatives, etc. and maintained extended family. In terms of producers surveyed, 82.0% and 12.0% were male and female, respectively. Majority of the producers (93.33%) were under the age group of 15 to 55 years which is considered as an active and working group. Most of the respondent (56.70%) lived jointly with their parents and third generation (Table 1).

Almost sixty-three (63.3%) belongs to graduation meaning having 16.0 years of education. Two types of on-farm income diversification were found in the study area, where 93.33% respondent’s income comes from agar oil and agar tree production. Approximately 67.0% has no formal credit access while 66.0% have a direct linkage with other social organization. About 78.0% respondent received training on agar oil production in the study areas (Table 1).

3.2 Determinants of Livelihood Improvement

A Logit model was estimated to elicit the factors influencing livelihood improvement of agar oil producers. Nine explanatory variables were identified to be major determinants of livelihood in this study. These were the age of household head, family size, level of education, occupational experience, annual income, access to credit, savings, membership of agar oil organization and having relatives abroad.

All the factors were a priori expected to have a positive impact on livelihood improvement. The result shows that the model was suitable (2 log-likelihood ratio test, 58.359) for explaining the determinants (Nagelkerke R Square, 0.560) of the livelihood improvement surveyed household. Among the variables considered in logistic regression analysis, four explanatory variables namely age of household head, annual income, credit access, and membership in an organization (significant at 5,10,5 and 1% probability level, respectively). The estimated result indicates that producers with a higher amount of annual income, more credit access, and member in an organization have a greater probability of improving their livelihood; the higher age of the household head has a lower probability of improving their livelihood than other (Table 2).

3.2.1 Age of household head

The result shows that the age of the household head had a negative value of coefficient and it was significant at 5% level. This indicates that the older the agar oil producers, the lower the probability of livelihood improvement. A unit increase in the age of agar oil producers will decrease the probability of livelihood improvement by an average 1.238 holding other factors remaining constant. That represents increased the age made them more unconscious about profitability as well as livelihood improvement (Table 2).

3.2.2 Years of schooling

The result shows that the years of schooling of the agar oil producers had a positive value of coefficient. This indicates that higher the educational level of agar oil producers, higher the probability of livelihood improvement. A unit increase in the years of schooling of agar oil producers will increase the probability of livelihood improvement by on an average 1.238 holding other factors remaining constant. That represents increased the years of schooling of agar oil producers made them more aware about the works, rights and responsibility as well as livelihood improvement (Table 2).
<table>
<thead>
<tr>
<th>Particulars</th>
<th>Percentage (%)</th>
<th>Particulars</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Family Size (No.)</td>
<td>10.17 (Small: 10.0%; Medium: 45.0% and Large: 45.0%)</td>
<td>Occupation (Secondary)</td>
<td></td>
</tr>
<tr>
<td>Age categories</td>
<td></td>
<td></td>
<td>Agriculture only</td>
</tr>
<tr>
<td>Below 15 years</td>
<td>0</td>
<td></td>
<td>Agriculture and others</td>
</tr>
<tr>
<td>15-55 years</td>
<td>93.33</td>
<td></td>
<td><strong>Organizational linkage</strong></td>
</tr>
<tr>
<td>Above 55 years</td>
<td>6.67</td>
<td>Yes</td>
<td>66.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>34.0</td>
</tr>
<tr>
<td>Average sex distribution (% of producers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>82.0</td>
<td>Experience</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12.0</td>
<td>11-30 years</td>
<td>36.67</td>
</tr>
<tr>
<td>Family Type</td>
<td></td>
<td>31 and above years</td>
<td>63.33</td>
</tr>
<tr>
<td>Joint family</td>
<td>56.7</td>
<td><strong>Credit Access</strong></td>
<td></td>
</tr>
<tr>
<td>Nuclear family</td>
<td>43.3</td>
<td>Yes</td>
<td>33.30</td>
</tr>
<tr>
<td>Literacy level</td>
<td></td>
<td>No</td>
<td>66.70</td>
</tr>
<tr>
<td>Higher secondary</td>
<td>36.7</td>
<td><strong>Training Received</strong></td>
<td></td>
</tr>
<tr>
<td>Graduation</td>
<td>63.3</td>
<td>Yes</td>
<td>78.33</td>
</tr>
<tr>
<td>Income within the farm</td>
<td></td>
<td>No</td>
<td>21.67</td>
</tr>
<tr>
<td>Agar oil + Agar tree producer</td>
<td>93.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agar oil + Agar tree producer+ livestock rearing</td>
<td>6.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Field survey, 2017*
Table 2. Estimated values of co-efficient and related statistics for measuring the Livelihood improvement

| Variables name                        | Estimates of coefficient | P>|z| | Exponential of coefficient or odds ratio | Estimates marginal effect |
|--------------------------------------|--------------------------|-------|--------------------------------------|---------------------------|
|                                      | Co-efficient β           | Standard of error | P>|z| | Exponential of coefficient or odds ratio | Estimates marginal effect |
| Intercept (β₀)                        | -3.990                   | 5.917  | 0.500                                | 0.000                     | -0.037                    | 50.58                     |
| Age of Household head (X₁)           | -0.168**                 | 0.080  | 0.037                                | 1.238                     | 0.023                     | 8.205                     |
| Family Size (X₂)                     | 0.121                    | 0.089  | 0.175                                | 1.123                     | 0.801                     | 4.28                      |
| Years of schooling (X₃)              | 0.129                    | 0.164  | 0.704                                | 1.421                     | 0.018                     | 1.29                      |
| Occupational Experience (X₄)         | -0.203                   | 0.151  | 0.180                                | 0.707                     | 0.004                     | 99290.808                 |
| Annual income (X₅)                   | 0.010*                   | 0.000  | 0.092                                | 1.000                     | 0.004                     | 99290.808                 |
| Credit access (X₆)                   | 0.001**                  | 0.000  | 0.049                                | 1.000                     | 0.004                     | 0.230                     |
| Savings (X₇)                         | 0.000                    | 0.000  | 0.412                                | 1.278                     | 0.567                     | 3459.08                   |
| Membership of organization (X₈)      | 2.378***                 | 0.831  | 0.004                                | 12.288                    | 0.005                     | 3.008                     |
| Relative in abroad (X₉)              | 0.753                    | 0.727  | 0.301                                | 0.809                     | 0.421                     | 0.980                     |

Source: Authors estimation based on field survey, 2017

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level
3.2.3 Occupational experience

Holding other factors remaining constant, a unit increase in the occupational experience will reduce the probability of livelihood improvement by on an average 0.707. The result shows that the occupation experience had a negative value of coefficient. Because in the study area, new comers can gain more profit with the high supervision power and working technique whereas used all techniques and spend more time in the factory were all times not possible for the old agar oil producers because of their age burden which gradually reduced the expected level of profit. So, the reason for such negative sign was that the other factors were more impact on the livelihood improvement rather than the occupational experience (Table 2).

3.2.4 Annual income

The result says that the annual income had a positive effect on livelihood improvement and it was significant at 10% level which implies that the larger the annual income greater the probability towards livelihood improvement of the household. Holding other factors fixed, one unit increase in annual income would lead to increase the probability of livelihood improvement by 1.000 (Table 2).

3.2.5 Credit access

The result says that the credit access had a positive effect on livelihood improvement and it was significant at 5% level which implies that the larger the credit access greater the probability towards livelihood improvement of the household through the formation of financial capital. Holding other factors fixed, one unit increase in credit access would lead to increase the probability of livelihood improvement by 1.000 (Table 2).

3.2.6 Membership of agar organization

The membership of agar organization had a positive value of coefficient and it was highly significant at 1% level. A unit increase in the membership of organization will increase the probability of livelihood improvement by on an average 12.288 holding other factors remaining constant. That represents agar oil producers having such membership get more opportunities in the uncertain situation and at the same time membership also indicates the symbol of unity which ultimately provided more scope for livelihood improvement (Table 2).

3.3 Determinants of Possible Constraints

The producers of agar oil faced various constraints in the process of production. The described constraints were lack of capital, lack of transportation, lack of information, lack of workers, lack of credit, lack of industrial gas connection, introspection by forestry, lack of modern technology, lack of modern laboratory, the difficulty of not getting CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) assurance. Among them lack of industrial gas connection and lack of modern laboratory was the major constraints faced by the producers.

3.3.1 Lack of capital

Lack of adequate capital is one of the major problems to run any type of business. Without capital, it is almost impossible for the agar oil producers to run their factory in the study area. Out of 60 agar oil producers, 5 faced this constraint at the high extent, 35 faced at the medium extent, 15 producers faced at the low extent and about 5 producers did not face this constraint. In this case, the computed value of CFI was 100 [(5*3) + (35*2) + (15*1) + (5*0)] against a possible range from 0 to 180 for each (Table 3).

3.3.2 Lack of transportation

Lack of transportation facilities can interrupt the success of any business. The transportation system in the study area was not poor. But the problem of transportation has arisen in the rainy season. Out of 60 agar oil producers, 1 faced this constraint at the medium extent, 35 faced at the medium extent, 15 producers faced at the low extent and about 5 producers did not face this constraint. In this case, the computed value of CFI was 32 against a possible range from 0 to 180 for each (Table 3).

3.3.3 Lack of information

Proper business information played a principal role in agar oil trading. But the study area this problem was not very high. Out of 60 agar oil producers, only 24 faced at the low extent and about 36 agar oil producers did not face this constraint. In this case, the computed value of CFI was 24 against a possible range from 0 to 180 for each (Table 3).
Table 3. Constraints faced by agar oil producers

<table>
<thead>
<tr>
<th>Constraints</th>
<th>High (3)</th>
<th>Medium (2)</th>
<th>Low (1)</th>
<th>Not at all (0)</th>
<th>CFI</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of capital</td>
<td>5</td>
<td>35</td>
<td>15</td>
<td>5</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>Lack of transportation</td>
<td>0</td>
<td>1</td>
<td>30</td>
<td>29</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>Lack of information</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>36</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Lack of workers</td>
<td>0</td>
<td>9</td>
<td>12</td>
<td>39</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>Lack of industrial gas connection</td>
<td>52</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>162</td>
<td>1</td>
</tr>
<tr>
<td>Introspection by forestry</td>
<td>2</td>
<td>6</td>
<td>28</td>
<td>24</td>
<td>52</td>
<td>7</td>
</tr>
<tr>
<td>Lack of modern technology</td>
<td>9</td>
<td>17</td>
<td>23</td>
<td>11</td>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>Lack of modern laboratory</td>
<td>25</td>
<td>17</td>
<td>12</td>
<td>6</td>
<td>121</td>
<td>2</td>
</tr>
<tr>
<td>Difficulty of not getting CITES assurance</td>
<td>10</td>
<td>15</td>
<td>10</td>
<td>25</td>
<td>70</td>
<td>6</td>
</tr>
<tr>
<td>Lack of credit</td>
<td>9</td>
<td>26</td>
<td>20</td>
<td>5</td>
<td>99</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2017

3.3.4 Lack of workers

Manpower is real power to run any type of business. Without efficient manpower work in any sector was not possible. In the rainy season shortage of human labor were prevailed in the study area. Out of 60 agar oil producers, 9 faced at the medium extent, 12 faced at the low extent and about 39 agar oil producers did not face this constraint. In this case, the computed value of CFI was 30 against a possible range from 0 to 180 for each (Table 3).

3.3.5 Lack of industrial gas connection

Lack of industrial gas connection is one of the major problems in the study area. As the production of agar oil was depended on the proper heating system, the agar oil producers were bare the highest cost of production because of commercial gas connection. Out of 60 agar oil producers, 52 faced this constraint at the high extent, 2 faced at the medium extent, only 2 agar oil producers faced at the low extent and about 4 agar oil producers did not face this constraint. In this case, the computed value of CFI was 162 against a possible range from 0 to 180 for each (Table 3).

3.3.6 Introspection by forestry

Sometimes the agar oil producers of the study area were faced introspection by forestry in case of trading. So, the introspection made by forestry sector exists in the study area. Out of 60 agar oil producers, 2 faced this constraint at the high extent, 6 faced at the medium extent, 28 faced at the low extent and about 24 did not face this constraint. In this case, the computed value of CFI was 52 against a possible range from 0 to 180 for each (Table 3).

3.3.7 Lack of modern technology

Lack of modern technology the development of business is impossible. In the study area, there was a huge gap of modern technology which was the obstacle in the path of proper development. Out of 60 agar oil producers, 9 faced this constraint at the high extent, 17 faced at the medium extent, 23 faced at the low extent and about 11 did not face this constraint. In this case, the computed value of CFI was 84 against a possible range from 0 to 180 for each (Table 3).

3.3.8 Lack of modern laboratory

Lack of modern laboratory the quality testing of agar oil was not performed. In the study area, no laboratory has been established yet to test the oil quality which was a major problem faced by the agar oil producers nowadays. Out of 60 agar oil producers, 25 faced this constraint at the high extent, 17 faced at the medium extent, 12 faced at the low extent and about 6 did not face this constraint. In this case, the computed value of CFI was 121 against a possible range from 0 to 180 for each (Table 3).

3.3.9 Difficulty of not getting CITES assurance

CITES certification is beneficial for every owner in order to get rid of from the problem of forestry. It was a way to run the business smoothly without the introspection of forestry. But this certificate was not available for everyone. So, the agar oil producers faced the problem of not getting CITES assurance. Out of 60 factory agar oil producers, 10 faced this constraint at the high extent, 15 faced at the medium extent, 10 faced at the low extent and about 25 did not face this constraint. In this case, the computed value of
CFI was 70 against a possible range from 0 to 180 for each (Table 3).

3.3.10 Lack of credit

All the agar oil producers in the study area were not economically solvent. They have acquired money from different sources with the high rate of interest rate. In the study area, agar oil producers mentioned that lack of credit with the low interest rate. Out of 60 agar oil producers, 9 faced this constraint at the high extent, 26 faced at the medium extent, 20 faced at the low extent and about 5 did not face this constraint. In this case, the computed value of CFI was 99 against a possible range from 0 to 180 for each (Table 3).

An overall situation of the constraints faced by the agar oil producers was implied Table 3. It revealed that, industrial gas problem with CFI 162 was ranked first, whereas, lack of modern laboratory with CFI 121, lack of capital with CFI 100, lack of credit with CFI 99, lack of modern technology with CFI 84, difficulty of not getting CITES assurance with CFI 70, introspection by forestry with CFI 52, lack of transportation with CFI 32, lack of workers with CFI 30, and lack of information with CFI 24, were ranked as second, third, fourth, fifth, sixth, seventh, eighth, ninth, and tenth, respectively.

4. CONCLUSION

The study concludes that producing agar oil contributes a great role in improving the well beings of its producers. The socioeconomic characteristics revealed that majority of the people in the study areas were depends on agar oil and agar tree production for their livelihood. And the active working groups were engaged themselves in the agar oil production which was almost ninety-three percentage because their livelihood improvement were largely depend on these sector. The result of Logit model showed that there was a chance for increasing the livelihood of the agar oil producers by increasing amount of annual income, credit access of household, participating of an organization and active age group of household head since the coefficient of this parameter was significant. Considering the findings of the study, it can be concluded that producing agar oil not only increase per capita income but also contribute to the upliftment of livelihood of its producers. Easy access to formal credit might help in formation of capital and producing more oil by the producers. The producing of agar oil has a positive impact on producer’s employment creation and income generation by increasing factory income reducing labour hours in the factory by adapting improved technology. As the production process has contributed a lot to livelihood, the government should be strengthening the production, processing and marketing capacity of agar oil producers as well as better access to industrial gas connection, modern laboratory, credit access and training for the agar oil producers.

DISCLAIMER

This article is original and contains unpublished materials. The corresponding author confirms that all of the authors have read and approved the manuscript and no ethical issues involved.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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