



## ASSESSING THE SOCIO-ECONOMIC CONDITIONS OF AGARWOOD INDUSTRY WORKERS: INSIGHTS FROM HOJAI DISTRICT

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### ABSTRACT

The history of the agarwood industry in Hojai dates back several decades, centered around the production of agarwood—a highly valued aromatic resinous wood formed in the heartwood of certain tree species of the genus *Aquilaria*, particularly *Aquilaria malaccensis*. The industry has significantly contributed to the socio-economic development of Hojai and its surrounding areas by creating employment opportunities for local communities and boosting the regional economy through the sale and export of products such as agarwood chips, oil, and incense. With a growing global demand for agarwood-based products like perfumes and incense sticks, the industry holds considerable economic and cultural importance. Primary data for this study were collected from 381 households during March and April 2024. The findings reveal that employment in the agarwood industry has substantially improved the socio-economic status of its workers, elevating them into lower-middle, middle, and upper-middle-income groups. This indicates that the industry serves as a pathway to upward mobility and financial stability, promoting equitable wealth distribution and narrowing socio-economic disparities. The study also highlights that out of the 381 surveyed households, 317 were residents, underscoring the industry's role in addressing unemployment within the region. Given its potential to generate employment and uplift local communities, the study recommends a proactive role for the government in supporting and developing the agarwood industry to harness its full socio-economic benefits.

### 1. INTRODUCTION

Agarwood, also known as oud, is a highly fragrant, dark resinous wood widely used in incense, perfume, and traditional medicine. It forms when the *Aquilaria* tree becomes infected with a specific mold, prompting the tree to produce a resin that hardens into agarwood. Renowned for its unique fragrance, often described as sweet, woody, and balsamic, agarwood is highly prized in global markets. It is extensively utilized in incense and perfume production and holds a significant place in traditional medicine (Zohar A. and Lev. E, 2013).

Native to Southeast Asia, agarwood is found in countries such as India, Indonesia, Malaysia, and Thailand. In recent years, Assam, particularly the district of Hojai, has seen a surge in agarwood cultivation due to its growing demand, especially for agarwood-based perfumes. The region's favourable climatic conditions, comparable to other agarwood producing countries, have further contributed to this trend.



Agarwood cultivation holds historical and cultural importance in Assam. Historically, the bark of the Sanchi tree (Agar) was used as a traditional writing material for manuscripts, including religious texts, literary works, and historical records. These manuscripts played a vital role in preserving and transmitting cultural and knowledge heritage across South Asia.

Agarwood plantations can occur naturally or artificially. Natural plantations involve growing *Aquilaria* trees in their native habitats, such as forests, where resin production depends on environmental factors like the presence of fungi and tree health. Naturally grown agarwood is considered superior in quality and value but is less predictable and more time-intensive. Conversely, artificial plantations involve cultivating *Aquilaria* trees in controlled environments such as nurseries or plantations. This method employs inoculation with fungi to stimulate resin production, enabling consistent, large-scale agarwood production. Artificial plantations also require careful management, including pruning and pest control.

In Hojai, Assam, agarwood cultivation is deeply embedded in the local economy and culture. The district has a long history of agarwood production and processing, with traditional expertise in cultivation, harvesting, and resin extraction. Over 2,000 small-scale and six large-scale agarwood industries operate in Hojai, directly employing approximately 50,000 people and benefiting an additional 1.5 lakh indirectly (The Telegraph, 2006). This highlights the economic and social significance of the agarwood industry in the region, positioning it as a cornerstone of Hojai's development.

## 2. LITERATURE REVIEW

The literature review explores the socioeconomic impact of agarwood production and trade on communities, economies, and the environment. Numerous studies have emphasized the industry's economic importance in supporting local livelihoods and national economies. For instance, Anshumi Dutta and Pranjal Protim Buragohain (2024) observed that the initial costs of agarwood cultivation are incurred during the first six years, after which expenses gradually decrease. Their research highlighted that agarwood workers generally avoided taking bank loans for cultivation, opting instead to save money in banks. The study concluded that agarwood production is both profitable and economically sustainable.

Agarwood oil production significantly enhances the well-being of its producers. Marium Bibi et al. (2019) noted that while the industry experiences a moderate-to-low shortage of workers, challenges such as the lack of industrial gas connections and modern technology remain significant obstacles. The study suggested improving credit facilities for agarwood producers to enhance the living conditions of workers in the sector.

Mohammed Rozi and Lee Yih Shiou (2016) explored the global demand for agarwood and discovered that consumer preferences vary across countries based on unique traditions and



perceptions of quality. Importing countries often have specific preferences for agarwood species, prompting the suggestion that exporting nations develop grading systems to standardize trade and tailor product quality to meet these demands.

Agarwood production and trade generate substantial income for small-scale producers, supporting rural economies and alleviating poverty. Bhagawati (2020) noted that the high market value of agarwood products, such as essential oils and incense, has spurred increased investment in cultivation and processing industries, leading to employment generation and value addition along the supply chain.

However, unsustainable harvesting of agarwood trees from natural forests has raised concerns about biodiversity loss and habitat destruction. Kanazawa Kentaro (2016) proposed sustainable harvesting practices, such as selectively cutting resin-accumulated tree sections while allowing trees to survive, to ensure long-term productivity without extensive forest logging.

The socioeconomic impact of agarwood production extends beyond economics to encompass social dimensions such as cultural heritage, community cohesion, and the preservation of traditional knowledge. In conclusion, agarwood production has a multifaceted impact, integrating economic, market, conservation, and social aspects. Future research should prioritize sustainable management, value chain optimization, and community involvement to enhance the positive outcomes of agarwood production while mitigating its environmental and societal drawbacks.

### 3. SIGNIFICANCE OF THE STUDY

Hojai, located in the Brahmaputra Valley, benefits from a tropical climate, abundant rainfall, and fertile soil—conditions ideal for cultivating agarwood trees. These trees produce resinous wood in response to stress or injury, making the region well-suited for sustainable agarwood cultivation. Agarwood plantations in Hojai contribute significantly to economic growth while supporting environmental conservation by reducing pressure on wild agarwood populations.

The cultivation and processing of agarwood in Hojai offer numerous benefits to the local community, including employment opportunities, particularly for rural households. Moreover, the industry aids in conserving natural forests by providing an alternative to harvesting wild agarwood. From an export perspective, the study of agarwood in Hojai is highly relevant due to the region's unique geographical and climatic conditions, which favor the production of high-quality agarwood. The trees grown here are renowned for their distinct fragrance and high resin content, making them highly desirable in international markets.

Although agarwood is not native to Hojai, it plays a vital role in the local economy through its cultivation, trade, and processing. In recent years, the agarwood industry in Hojai has gained prominence as local farmers increasingly recognize its economic potential. However, the long-

term sustainability of the industry depends on implementing responsible management and harvesting practices.

The factors outlined above underscore the significance of studying agarwood production in Hojai. The region’s unique conditions and its growing role in the global agarwood trade highlight the importance of sustainable practices to ensure continued economic and environmental benefits.

4. OBJECTIVES

- i. To evaluate the impact of the agarwood industry on the socio-economic status of its workers.
- ii. To analyse the factors affecting monthly income of the agarwood workers.
- iii. To propose strategies for enhancing the development of the agarwood industry.

6.METHODOLOGY

The study is both analytical and descriptive in nature, utilizing both primary and secondary data. Hojai is purposively considered as the study area because it is a prominent hub for agarwood cultivation and trade in Assam, with its long-standing tradition of agarwood processing, while snowball sampling was used to gather data from 381 participants. Prior to data collection, a pilot test was conducted with agarwood workers. Data were collected using a pretested questionnaire. The collected data were analyzed using MS Excel and SPSS software.

The socio-economic status (SES) of households involved in the agarwood industry was assessed using the Kuppuswamy scale because Hojai district, located in Assam, India, is an urban agglomeration area that includes the town of Hojai and its surrounding suburban areas. It serves as a key administrative and commercial center within the Nagaon district, with a growing population and infrastructure. The area is characterized by a mix of urban and rural features, with development concentrated in key sectors such as transportation, education, and commerce. This scale is a widely used tool for measuring SES in urban areas, based on three parameters: education, occupation, and income. It provides a composite score ranging from 3 to 29, which classifies families into five SES groups: Upper class, Upper middle class, Lower middle class, Upper lower class, and Lower class.

5. FINDINGS

5.1 Class division of workers of agarwood industry

Table 1. Class division of workers of agarwood industry

LOWER CLASS	0
UPPER LOWER CLASS	30
MIDDLE CLASS	181
UPPER MIDDLE CLASS	170
UPPER CLASS	0



Source: Sample survey

Table 1 shows the socio economic status of the workers working in the agarwood industry (Kuppuswamy scale). The workers are scattered over three classes mainly: the upper lower class, middle class and the upper middle class. Workers of the agarwood industry are found to be neither in the lower class nor in the upper class.

Fig 1. Percentage of workers belonging to different class

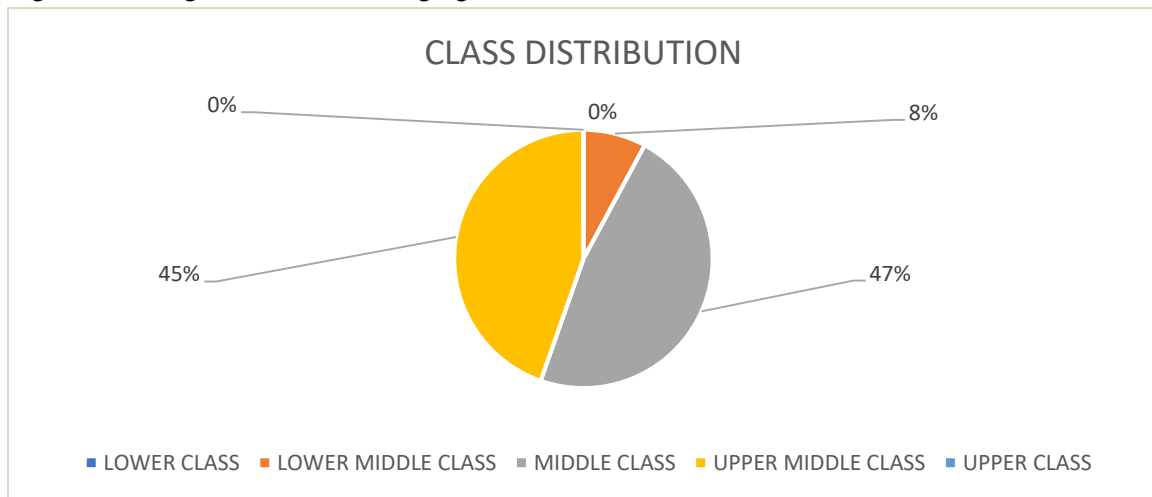


Figure 1 indicates that the majority of workers i.e. 47% belong to the middle class, 45% belong to the upper middle class and 8% belong to upper lower class and no workers belong to either lower class or upper class.

## 6.2. Female and male workforce at agarwood industry

Table 2. No. of female and male workers

FEMALE COUNT	112
MALE COUNT	269
TOTAL	381

Source: Sample survey

Table 2. shows the no. of female and male workers involved in the agarwood industry. Female workers occupy only 29% of the total workers while male workers are 71% of the total workers which is more than twice the proportion of female workers. Here, the low female workforce participation rate is clearly visible.

## 6.3. Average monthly income of female and male workers

Table 3: Wages of female and male workers

GENDER	TOTAL WEIGHTAGE OF MONTHLY INCOME	AVERAGE WEIGHT OF MONTHLY INCOME	AVERAGE MONTHLY INCOME
FEMALE	659	5.88~6	7975
MALE	2656	9.88~10	13672

Source: Sample survey

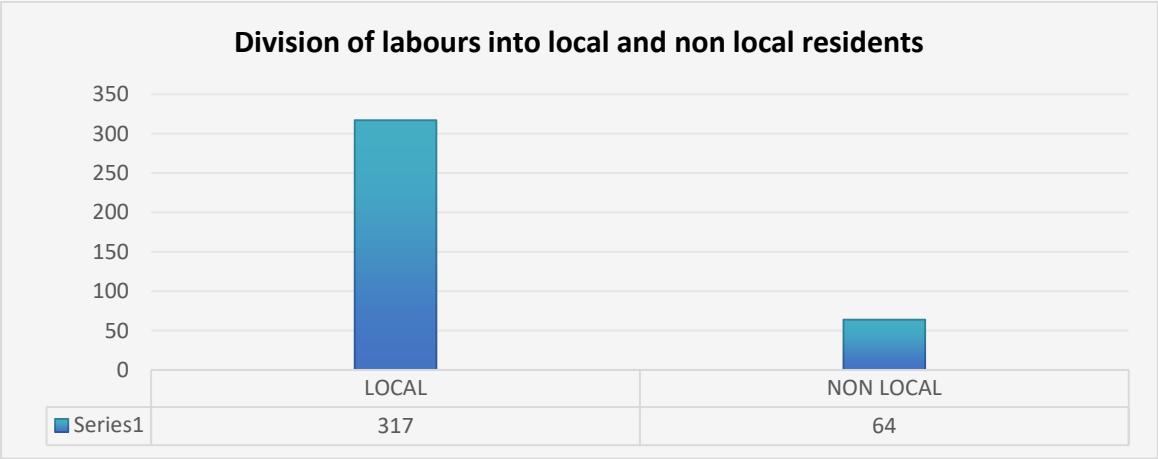


Table 3 shows the average monthly income that a female and male worker in the agarwood industry earns. The total weight of monthly income of female and male workers were found to be 659 and 2656 respectively (kuppuswamy scale). The average weight of monthly income stood at approx 6 and 10 respectively for female and male workers which indicates average monthly income for female workers to be Rs. 7975 and Rs. 13672 as average monthly income for males. A massive wage rate disparity can be seen from the results obtained. The average male wage was found to be 71% more than that of a female worker.

#### 6.4. Employment generated

In addition to its economic significance, this industry is distinguished by its pivotal role in fostering employment opportunities and socioeconomic progress. Agarwood production encompasses various stages, from cultivation to product manufacturing. These processes require manual labor, such as cutting trees, extracting agarwood resin, and refining it into various products.This creates a diverse range of jobs, from agricultural work in cultivating agarwood trees to skilled labor in crafting agarwood products. Thus, it can absorb workers with different skill sets and educational backgrounds. In many cases, agarwood harvesting and processing techniques are passed down through generations. This means that even individuals without formal education can find employment in the industry by utilizing traditional knowledge and skills.

Fig. 2: Division of labours into local and non-local residents



Source: Survey  
 Out of 381 samples 317 are local people working in the agarwood industry which is 83% of the sample surveyed while the strength of non local workers stood at 64 which is 17% of the sample surveyed.

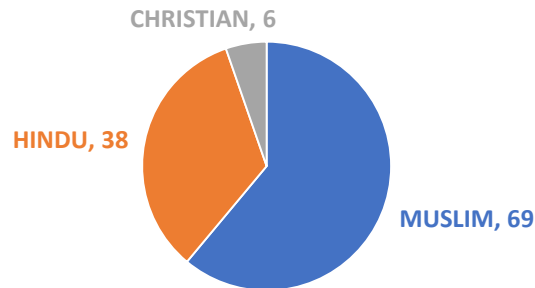
#### 6.5. Female labour force participation rate among muslim women

Studies have shown that Muslim women face challenges in accessing and participating in the labor force. In some regions Muslim women have high labor force participation rates, while in others, they face significant barriers to entry and participation in the workforce.

Fig. 3: Division of women workers on the basis of religion



### Division of women workers on the basis of religion



Source: Sample survey

In this industry, a notable transformation has occurred, particularly evident in the increased engagement of Muslim women. Traditionally constrained by societal norms and cultural expectations, Muslim women have emerged as prominent participants. Their heightened involvement not only reflects a shift towards inclusivity and diversity but also signifies a broader societal evolution towards gender equality and empowerment.

#### 6.6 Wage gap

An independent sample t-test was conducted to compare the average wage between male and female workers.

$H_0$  = There is no difference in the average wage of male and female workers

$H_1$  = There is difference in the average wage of male and female workers.

The results revealed that there was significant difference {  $t(389) = -33.58$ ,  $p = 0.000$  } in the average wage with mean wage of male workers (Mean = 12309, SD= 1289.25) higher than female workers (Mean= 7519, SD= 1250.42).

The magnitude of the differences in the mean (mean difference= 4788.72, 95%CI 5069.08 to 4508.35) was significant. Hence,  $H_1$  was supported.

Now that it is evident to us that wage gap exists between male and female workers, we further seek to analyse if it is only gender that influences the wage gap or are there other factors also contributing to it. In order to investigate to what extent is income influenced by age, gender, education level and work experience, the following hypothesis were proposed:

$H_{0I}$ : There is a no significant impact of age on income level.

$H_{0II}$ : There is a no significant impact of education level on income.

$H_{0III}$ : There is a no significant impact of gender on income level.

$H_{0IV}$ : There is a no significant impact of work experience on income level.

The dependent variable (income) was regressed on predicting variables of age, gender, education level and work experience. The independent variables significantly predict the income level,  $F(4, 376) = 320.216$ ,  $p < 0.001$ , which indicates that the four factors under study have a significant impact on income. Moreover, the  $R^2 = 0.773$  which depicts that the model explains 77.3% of the variance in income level.

ANOVA<sup>b</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.878E9	4	4.695E8	320.216	.000 <sup>a</sup>
	Residual	5.513E8	376	1466244.778		
	Total	2.429E9	380			

a. Predictors: (Constant), WORKEXP, KPEDU, GENDERID, AGE

b. Dependent Variable: INCOME

Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.879 <sup>a</sup>	.773	.771	1210.88595

a. Predictors: (Constant), WORKEXP, KPEDU, GENDERID, AGE

b. Dependent Variable: INCOME

Further analysis were done to ascertain the influence of each independent variable on the dependent variable.

H<sub>0</sub>I evaluates whether age has significant impact on income level. The results revealed that age has no significant impact on income level (  $\beta$ =-0.005,  $t$ =-0.137,  $p$ = 0.891). Hence, H<sub>0</sub>I is accepted.

H<sub>0</sub>II evaluates whether education level has significant impact on income. The results revealed that education level has no significant impact on income ( $\beta$ =0.031 , $t$ =1.157 ,  $p$ = 0.248). Hence, H<sub>0</sub>II is accepted.

H<sub>0</sub>III evaluates whether gender has a significant impact on income level. The results revealed that gender has a significant impact on income level ( $\beta$ =0.757 ,  $t$ = 23.941,  $p$ = 0.000). Hence, H<sub>0</sub>III is rejected.

H<sub>0</sub>IV evaluates whether work experience has a significant impact on income. The results revealed that work experience has a significant impact on income ( $\beta$ =0.194 , $t$ =4.826 ,  $p$ = 0.000). Hence, H<sub>0</sub>IVis rejected.



Coefficients<sup>a</sup>

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1(Constant)	3112.062	437.232		7.118	.000	2252.335	3971.788		
AGE	-.984	7.161	-.005	-.137	.891	-15.064	13.097	.493	2.027
GENDER ID	4187.238	174.898	.757	23.941	.000	3843.337	4531.139	.603	1.658
KPEDU	66.137	57.152	.031	1.157	.248	-46.241	178.515	.834	1.199
WORKEXP	4.856	1.006	.194	4.826	.000	2.877	6.834	.374	2.672

a. Dependent Variable: INCOME

The findings indicate that the wage gap between male and female workers is influenced not only by gender but also by differences in work experience among these workers.

## 6. SUGGESTIONS

The agarwood industry employs a considerable number of semi-skilled and unskilled workers. Industries that provide employment opportunities across a range of skill levels—from unskilled to highly skilled—are regarded as employment generators. An industry with strong demand both locally and globally is likely to expand, further driving job creation. For such an employment-generating industry, like the agarwood industry to thrive, government can support the industry by simplifying regulations for trade, offering financial incentives, and establishing research centers to develop better extraction and processing technologies.

The agarwood industry also fosters backward and forward linkages that indirectly create additional employment opportunities. On the backward linkage front, promoting sustainable plantation practices by supporting farmers with quality saplings, technical knowledge, and access to affordable inputs is critical. Additionally, providing financial assistance or subsidies for setting up nurseries and implementing inoculation technologies can boost raw material availability.



On the forward linkage side, investments in processing infrastructure, such as distillation units for agarwood oil and facilities for crafting agarwood-based products, can add significant value. Creating marketing platforms, such as trade fairs and e-commerce channels, can connect producers to global markets. Encouraging branding and certification for sustainably sourced agarwood will attract premium buyers and foster consumer trust. Collaborative efforts between government, industry stakeholders, and researchers to explore new uses and derivatives of agarwood can further expand market demand and create more employment opportunities across the value chain.

## 7. LIMITATION

The findings of this study are specific to the sample area, Hojai, and may not be directly applicable to other regions. Results may vary if the study is conducted in a different demographic setting

## 8. CONCLUSION

Out of the 381 samples collected, 181 respondents were from the middle class, 170 from the upper-middle class, and 30 from the lower-middle class. This indicates that workers in the agarwood industry generally have access to essential social amenities such as education, occupation, and income. The industry has been instrumental in tackling local unemployment by creating substantial employment opportunities. Its operations have successfully absorbed a significant share of the unemployed population, providing them with avenues for meaningful work and economic stability.

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