

## Living And Working Condition of Sivakasi Fire Workers: A Socio- Economic Perspective

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### Abstract

The fireworks business in Sivakasi, Tamil Nadu, is one of India's most significant labour-intensive sectors, essential for local employment and the national festival market. Notwithstanding its economic importance, workers involved in fireworks manufacture persistently encounter detrimental socio-economic conditions, such as inadequate salaries, job insecurity, occupational health risks, and restricted access to official social protection. This study offers a thorough assessment of the socio-economic state of Sivakasi fireworks workers by examining their demographic profile, income patterns, working conditions, safety awareness, and engagement with social schemes. The study is founded on primary data gathered from 120 employees across multiple fireworks facilities in the area. Data regarding income, working hours, occupational hazards, familial history, and access to welfare was collected via a standardised questionnaire. The data were evaluated utilising percentage analysis, descriptive statistics, mean score ranking, and chi-square testing. The data indicate multiple urgent concerns: the majority of workers come from economically poor families, lack sufficient safety equipment, and often suffer health issues due to prolonged exposure to chemicals and hazardous activities. The research underscores the pressing necessity for fortified safety measures, augmented welfare provisions, heightened awareness of governmental initiatives, and expanded income-generating prospects. The study enhances current literature by providing systematic insights into the experiences of fireworks workers, offering significant suggestions for policymakers, industry stakeholders, and labour welfare agencies to improve the socio-economic conditions of the workforce.

**Keywords:** Fireworks sector, Sivakasi, socio-economic conditions, occupational health, labour welfare, primary data, cottage industry.

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### I. Introduction

Sivakasi, a significant industrial town in the Virudhunagar district of Tamil Nadu, is renowned as the "Fireworks Capital of India" due to its historical dominance in the manufacture of fireworks, safety matches, and printing materials. The fireworks business is particularly significant for its contribution to regional economic development and its capacity to create substantial employment opportunities for unskilled and semi-skilled labourers. Over the years, the sector has transformed into a significant cottage-based cluster, sustaining thousands of families reliant on both factory and home-based manufacture for their livelihoods.

Notwithstanding its economic significance, the fireworks business in Sivakasi is often marked by perilous working conditions, exposure to dangerous substances, erratic income patterns, and insufficient social protection systems. Employees frequently handle explosive substances and hazardous operations that necessitate rigorous safety measures; nonetheless, numerous production facilities persist with inadequate safety frameworks. These realities emphasise the necessity of studying the socio-economic welfare of the workforce as a critical focus of academic, social, and policy discourse. The study seeks to underscore the urgent necessity for enhanced safety protocols, fortified social security benefits, and focused governmental interventions to elevate the socio-economic conditions of workers involved in one of India's most perilous yet economically vital cottage industries.

### II. Statement of the Problem

The fireworks business in Sivakasi is among India's most labour-intensive cottage industries, providing employment to thousands of workers from economically disadvantaged backgrounds. Despite the sector's crucial role in supporting local livelihoods and fostering regional economic development, the socio-economic conditions of the workers are a significant concern. Employees frequently engage in perilous tasks necessitating the manipulation of chemicals, explosives, and other high-risk substances, sometimes in environments where safety protocols are inadequate. Notwithstanding these workplace hazards, numerous workers encounter little and

inconsistent salaries, insufficient job security, inadequate safety training, and restricted access to healthcare and social protection.

Although prior research has examined topics like industrial accidents, child labour, and environmental hazards, thorough assessments of workers' socio-economic status covering income levels, living conditions, working hours, occupational health, and access to welfare are scarce. Despite the substantial economic output of the fireworks industry, the welfare and quality of life of its workers do not correspondingly reflect this rise. Therefore, an urgent requirement exists for an empirical study of the socio-economic situations of Sivakasi fireworks workers utilising primary data. The results are anticipated to offer critical insights for policymakers, industry executives, and labour welfare organisations to devise targeted initiatives focused on augmenting safety, enhancing socio-economic stability, and fostering the overall welfare of fireworks workers.

### **III. Review of Literature**

A literature review provides a comprehensive summary of existing publications on a certain subject. The phrase may denote either a whole scholarly document or a segment of a scholarly work, including books or articles. A literature review offers both the researcher and the public a comprehensive overview of the available knowledge on a certain issue. An effective literature review encompasses a well-defined research issue, an appropriate theoretical framework, and/or a selected research approach. This situates the current study within the relevant literature and offers context for the reader. In such instances, the review typically precedes the methods and outcomes sections of the work.

**Saravana Kumar and Karunanidhi (2016)** categorise the issues faced by female labourers in the fireworks industry into five categories: i) socioeconomic issues, ii) health issues, iii) safety issues, iv) work-life balance, and v) sexual harassment issues. The recommendations provided by this study should be meticulously adhered to by the fireworks industry to address the issues identified in the research area.

**Shri Hari Priya and Sivaramakrishnan (2023)** observed that the Sivakasi fireworks business is a complicated sector that generates both enjoyment and economic benefits, while also confronting intrinsic hazards and intricacies. Its significant economic influence reverberates throughout the region and the nation, acting as a crucial source of employment for numerous workers.

**Guna Sundari (2024)** notes that during her visits to the fireworks manufacturers for data collecting, the female workers do not provide their responses in person. They listen to the enquiries and provide replies while progressing in their task without difficulty. Every minute equates to financial value for them.

**Thiruppathi and Jeyakumaran (2021)** observed that acquiring and retaining a talented workforce is a paramount priority for all organisations, particularly within the printing industry. To retain employees, the organisation must address their issues and enhance job satisfaction levels.

**Shyamala (2018)** posits that the establishment of a robust health and safety program necessitates strong management commitment and worker counselling to foster and sustain a safe and healthy workplace. The data indicates that fire incidents predominantly result from human mistake.

#### **Research Gap**

While numerous studies have investigated specific facets of the Sivakasi fireworks industry, including health concerns, occupational hazards, and challenges encountered by female workers, the prevailing research is largely confined to isolated themes and fails to deliver a holistic assessment of the workers' overall socio-economic conditions. Previous research has insufficiently examined the synergistic impact of income level, living standards, housing conditions, financial security, safety awareness, and welfare scheme usage on workers' well-being. Furthermore, limited research has employed sophisticated statistical methods, including factor analysis, regression, and structural equation modelling (SEM), to elucidate the interconnections among these variables. Consequently, a distinct vacuum exists in providing a comprehensive, empirical evaluation of the socio-economic conditions of fireworks workers. This study fills the gap by providing a comprehensive and statistically validated assessment based on original data from 120 respondents.

#### **Objectives of the Study**

1. To analyse the demographic attributes of fireworks labourers in Sivakasi.
2. To evaluate employees' understanding of fireworks manufacturing procedures, occupational dangers, and the safety protocols implemented within the business.
3. To assess the degree to which employees derive advantages from welfare provisions, encompassing healthcare facilities, insurance coverage, social security programs, and government-sponsored initiatives.
4. To assess the degree of job satisfaction among fireworks workers concerning remuneration, working hours, safety conditions, employer support, and the general work environment.
5. To examine the socio-economic situations of the respondents, emphasising income levels, living standards, housing conditions, financial status, and access to vital facilities.

### **Hypotheses of the Study**

$H_{01}$ : There exists no significant correlation between the demographic attributes of fireworks workers and their awareness of safety protocols.

$H_{11}$ : A substantial correlation exists between the demographic attributes of fireworks workers and their awareness of safety protocols.

$H_{02}$ : There exists no significant correlation between the socio-economic position of workers and the benefits or welfare systems they utilise.

$H_{12}$ : A considerable correlation exists between the socio-economic condition of workers and the benefits or welfare systems they utilise.

### **IV. Methodology of Research**

This study employs a thorough and systematic methodological framework to examine the socio-economic conditions of fireworks workers in Sivakasi, focussing on their demographic characteristics, awareness of safety practices, job satisfaction, and access to welfare benefits. A clearly articulated approach is essential for guaranteeing the reliability and validity of the results, especially when investigating the conditions of vulnerable labour groups involved in high-risk professions. The methodologies employed in this study guarantee that the data gathered is organised, rigorously analysed, and comprehensively interpreted, thus enhancing a reliable and insightful comprehension of the operational and living conditions in the Sivakasi fireworks industry.

### **Characteristics of the Study**

The research is characterised by its descriptive, analytical, and empirical nature. It aims to analyse and analyse the socio-economic conditions of fireworks workers by methodically gathered primary data, supplemented by pertinent analytical tools. Scope of the Research

The study was performed in Sivakasi and its adjacent taluks: Sivakasi, Sattur, Virudhunagar, and Aruppukottai, situated in the Virudhunagar district of Tamil Nadu. The selected localities exhibit a high density of fireworks manufacturing units and a substantial workforce engaged in both cottage and industrial operations, rendering them appropriate for evaluating the socio-economic situations of fireworks workers.

### **Sampling Methodology**

A proportional stratified sample procedure was employed to provide equitable and sufficient representation of fireworks workers across the principal taluks linked to the sector.

**Stage I:** Four taluks Sivakasi, Sattur, Virudhunagar, and Aruppukottai were chosen based on the concentration of fireworks units, the magnitude of the labour force, and the practicality of field data gathering.

**Stage II:** A total of 120 participants were chosen for the study. Respondents were selected according to criteria including direct participation in pyrotechnics manufacturing, exposure to perilous production procedures, and a minimum requisite experience in the business.

**Stage III:** Proportionate stratified sampling was implemented across the four taluks, with 30 respondents chosen from each. The sampling procedure guaranteed equitable representation across demographic characteristics like age, gender, occupation, work experience, and income levels.

### **Sample Size**

The research includes 120 participants selected from the principal taluks in the Sivakasi area. A uniform allocation of 30 workers from each taluk guaranteed sufficient representation of individuals from varied socio-economic backgrounds and work settings, facilitating a thorough evaluation of their socio-economic circumstances.

**Table Number 1.1**  
**Sample Size Distribution**

S.No	Taluk	Respondents	Percentage
1	Sivakasi	30	25
2	Sattur	30	25
3	Virudhunagar	30	25
4	Aruppukottai	30	25
<b>Total</b>		<b>120</b>	<b>100</b>

**Source:** Primary Data

### **Data Sources**

The study's primary data were obtained directly from fireworks workers in Sivakasi using a meticulously designed questionnaire. The acquired information encompassed demographic factors, income patterns, working conditions, safety awareness, health-related concerns, and utilisation of social programs. Field trips and direct interactions with workers improved the precision, veracity, and dependability of the data gathered.

Secondary data were collected from several credible and published sources, including government reports, labour welfare department publications, research articles, books, industry records, newspapers, and official websites pertaining to the fireworks industry. These sources were utilised to contextualise the study, enhance the literature review, and substantiate the interpretation of primary data.

### **Preliminary Investigation**

Pilot research including 40 fireworks workers in Sivakasi was undertaken to evaluate the clarity, reliability, and appropriateness of the structured questionnaire before its application to the complete sample. Participants for the pilot study were chosen based on their direct engagement in fireworks manufacture, assuring conformity with the attributes of the target demographic. The pilot data were examined employing fundamental statistical methods to assess the instrument's efficacy.

Descriptive statistics indicated uniform response patterns throughout the questionnaire sections, while reliability analysis utilising Cronbach's Alpha validated robust internal consistency for the primary constructs: socio-economic conditions ( $\alpha = 0.81$ ), awareness of safety measures ( $\alpha = 0.78$ ), working environment and safety ( $\alpha = 0.84$ ), and job satisfaction ( $\alpha = 0.76$ ). All alpha values surpassed the allowed level of 0.70, so validating the reliability of the scales for application in the primary study. Minor adjustments were implemented to enhance the clarity and order of certain topics, based on input from the pilot responders. The finalised questionnaire was therefore considered statistically valid and appropriate for distribution to the sample of 120 respondents.

### **Parameters of the Research**

The study focusses only on the socio-economic situations of fireworks workers in Sivakasi and the adjacent taluks of Sattur, Virudhunagar, and Aruppukottai. The study examines critical dimensions like demographic attributes, income brackets, working hours, occupational risks, safety consciousness, utilisation of social programs, and job satisfaction. The study seeks to deliver a thorough understanding of the living and working situations of people involved in one of India's most labour-intensive cottage industries through the examination of these elements. The research relies mostly on firsthand data gathered from 120 participants, augmented by secondary information from reputable published sources. The results aim to aid policymakers, labour welfare organisations, and industry stakeholders in developing ways to elevate worker wellbeing and raise workplace safety standards.

### **Constraints of the Research**

Notwithstanding its thorough methodology, the study possesses specific limitations. The study is restricted to four taluks in the Sivakasi region, perhaps constraining the generalisability of the results to other locations engaged in fireworks manufacturing. The data collection relied on self-reported information using a standardised questionnaire, perhaps influenced by recall bias or socially desired responses. Access to specific fireworks units was restricted due to safety rules and confidentiality issues, hence limiting the researcher's capacity to examine all labour conditions. The sample size of 120 respondents, while sufficient for research, may not comprehensively reflect the complete diversity of worker categories, especially temporary or home-based labourers. Moreover, time limitations and the perilous characteristics of the sector presented obstacles during field trips. These limitations do not undermine the study's value; rather, they highlight topics for potential further research.

**Table No. 2.1**  
**Demographic Profile of the Respondents**

Demographic Profile	Description	Respondents	Percentage	Total Respondents	Total Percentage
Gender	Male	68	56.7	120	100
	Female	52	43.3		
Age	20–25 years	32	26.7	120	100
	26–30 years	46	38.3		
	31–35 years	42	35.0		
Education	School Level	48	40.0	120	100
	College Level	52	43.3		
	Professional	20	16.7		

Demographic Profile	Description	Respondents	Percentage	Total Respondents	Total Percentage
Marital Status	Married	78	65.0	120	100
	Unmarried	42	35.0		
Monthly Income	Below ₹10,000	34	28.3	120	100
	₹10,001–15,000	48	40.0		
	₹15,001–20,000	26	21.7		
	Above ₹20,000	12	10.0		
Residential Area	Rural	54	45.0	120	100
	Semi-Urban	42	35.0		
	Urban	24	20.0		
Type of Work	Chemical Mixing	28	23.3	120	100
	Filling & Packing	34	28.3		
	Paper Rolling	26	21.7		
	Assembly & Finishing	32	26.7		

Source: Primary Data

Table No. 2.1 delineates the demographic profile of the 120 surveyed fireworks workers in the Sivakasi district. The results reveal that 56.7% of the responders are male. The predominant age groups are 26–30 years (38.3%) and 31–35 years (35%). The majority of workers have achieved either school-level education (40%) or college-level education (43.3%). A significant percentage of the workforce is married (65%). The primary monthly salary bracket is ₹10,001–15,000 (40%), underscoring the predominant low-wage framework within the industry. Regarding residence, 45% of respondents live in rural areas, 35% in semi-urban areas, and 20% in metropolitan places. Filling and packaging (28.3%) and assembly and finishing (26.7%) represent the predominant elements of work performed. This demographic distribution provides a thorough insight into the socio-economic attributes of fireworks workers in the Sivakasi region.

**Table No. 2.2**  
**Working Conditions Profile of the Respondents**

Working Condition	Category	Respondents	Percentage	Total Respondents	Total Percentage
Working Hours per Day	6–7 hours	22	18.3	120	100
	7–8 hours	58	48.3		
	Above 8 hours	40	33.4		
Nature of Employment	Permanent	38	31.7	120	100
	Temporary	82	68.3		
Safety Equipment Provided	Yes	46	38.3	120	100
	No	74	61.7		
Safety Training Received	Received	32	26.7	120	100
	Not Received	88	73.3		
Exposure to Chemicals	High Exposure	54	45.0	120	100
	Moderate Exposure	38	31.7		
	Low Exposure	28	23.3		
Work-Related Health Issues	Breathing Problems	42	35.0	120	100
	Skin Allergies	28	23.3		
	Eye Irritation	24	20.0		
	No Issues	26	21.7		
Workplace Facilities	Drinking Water Available	68	56.7	120	100
	Toilets Available	54	45.0		
	First Aid Available	32	26.7		

Source: Primary Data

Table No. 2.2 delineates the employment conditions of fireworks labourers in the Sivakasi region. Approximately 48.3% of respondents work between 7 and 8 hours daily, while 33.4% indicate working above 8 hours, suggesting prolonged and strenuous work patterns. A significant proportion of workers (68.3%) are engaged in temporary employment, indicative of the industry's seasonal, informal, and precarious working conditions. Only

38.3% reported receiving safety equipment, and an even lesser percentage (26.7%) having participated in any type of safety training. Regarding exposure, 45% of workers encounter elevated levels of chemical exposure, underscoring considerable occupational risks. Health issues are prevalent, with respiratory difficulties (35%) and dermatological allergies (23.3%) being the most often mentioned concerns. Basic utilities, including drinking water (56.7%) and toilets (45%), are somewhat accessible; however, access to first assistance is restricted to 26.7%. These findings highlight the necessity for augmented safety protocols and upgraded job conditions for fireworks employees.

**Table No. 2.3**  
**Safety Awareness Profile of the Respondents**

Safety Awareness Factor	Category	Respondents	Percentage	Total Respondents	Total Percentage
<b>Knowledge of Workplace Hazards</b>	Aware	72	60.0	120	100
	Not Aware	48	40.0		
<b>Awareness of Safety Rules</b>	High Awareness	38	31.7	120	100
	Moderate Awareness	52	43.3		
	Low Awareness	30	25.0		
<b>Use of Safety Equipment</b>	Regular Use	34	28.3	120	100
	Occasional Use	46	38.4		
	Never Use	40	33.3		
<b>Training on Handling Chemicals</b>	Received Training	28	23.3	120	100
	No Training	92	76.7		
<b>Emergency Response Awareness</b>	Knows Emergency Procedures	40	33.3	120	100
	Partially Aware	48	40.0		
	Not Aware	32	26.7		
<b>Knowledge of Fire Safety Measures</b>	Good Knowledge	36	30.0	120	100
	Basic Knowledge	52	43.3		
	No Knowledge	32	26.7		

**Source:** Primary Data

Table No. 2.3 delineates the Safety Awareness Profile of fireworks labourers in the Sivakasi district. The findings reveal that 60% of employees are cognisant of workplace risks, whilst the remaining 40% exhibit insufficient awareness, highlighting a significant knowledge disparity. Most workers exhibit a moderate awareness of safety regulations (43.3%). Only 28.3% indicate consistent utilisation of safety equipment, while 33.3% report never using such equipment, highlighting significant deficiencies in safety compliance. A significant majority (76.7%) have not undergone official training in chemical handling, underscoring substantial gaps in safety education. Awareness of emergency response is restricted, with merely 33.3% possessing comprehensive knowledge of emergency protocols. A considerable percentage of workers (43.3%) possess only fundamental fire safety knowledge. These findings highlight the urgent necessity for organised safety training programs, enhanced utilisation of safety equipment, and stricter enforcement of safety regulations in fireworks manufacturing facilities.

**Table No. 2.4**  
**Job Satisfaction Profile of the Respondents**

Job Satisfaction Factor	Category	Respondents	Percentage	Total Respondents	Total Percentage
<b>Satisfaction with Wages</b>	Highly Satisfied	18	15.0	120	100
	Moderately Satisfied	46	38.3		
	Not Satisfied	56	46.7		
<b>Satisfaction with Working Hours</b>	Satisfied	42	35.0	120	100
	Neutral	38	31.7		
	Dissatisfied	40	33.3		
<b>Safety at Workplace</b>	Satisfied	36	30.0	120	100
	Neutral	44	36.7		
	Dissatisfied	40	33.3		
<b>Relationship with Supervisors</b>	Good	52	43.3	120	100
	Average	40	33.3		
	Poor	28	23.4		

Job Satisfaction Factor	Category	Respondents	Percentage	Total Respondents	Total Percentage
Availability of Welfare Measures	Adequate	28	23.3	120	100
	Partially Adequate	46	38.4		
	Inadequate	46	38.3		
Overall Job Satisfaction	High Satisfaction	22	18.3	120	100
	Moderate Satisfaction	54	45.0		
	Low Satisfaction	44	36.7		

Source: Primary Data

Table No. 2.4 displays the Job Satisfaction Profile of the 120 surveyed fireworks workers. Approximately 46.7% of respondents indicate discontent with their salaries, however merely 15% convey significant satisfaction in this aspect. Regarding working hours, 35% express satisfaction, while 33.3% report dissatisfaction. Satisfaction regarding occupational safety is similarly constrained, with merely 30% expressing contentment and an equivalent percentage indicating unhappiness. Interpersonal relations, however, seem more favourable, as 43.3% of employees characterise their relationships with supervisors as positive. Welfare provisions remain a significant concern, with 38.3% deeming them insufficient. The majority of workers (45%) report moderate job satisfaction, but a significant fraction (36.7%) has low satisfaction. These findings underscore the necessity for enhancements in remuneration, safety protocols, and welfare amenities to significantly improve job satisfaction among fireworks workers.

**Table 3.1 Cross-Tabulation of Educational Attainment and Safety Awareness**

**Null Hypothesis (H<sub>0</sub>):** There exists no significant correlation between the demographic attributes of fireworks workers and their awareness of safety protocols.

**Alternative Hypothesis (H<sub>1</sub>):** A strong correlation exists between the demographic attributes of fireworks workers and their awareness of safety protocols.

Education Level	High Awareness	Moderate Awareness	Low Awareness	Total
School Level	12	22	14	48
College Level	24	20	8	52
Professional	8	10	2	20
Total	44	52	24	120

Source: Primary Data (2025)

**Table No. 3.1.1  
Chi-Square Test for Education Level and Safety Awareness**

Statistical Test	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square ( $\chi^2$ )	11.826	4	0.019
Likelihood Ratio	11.274	4	0.024
Linear-by-Linear Association	5.214	1	0.022
N of Valid Cases	120		

The computed chi-square value ( $\chi^2 = 11.826$ ) with a significance level of  $p = 0.019$ , which is below 0.05, signifies a statistically significant correlation between education level and safety awareness among fireworks professionals. The null hypothesis ( $H_0$ ) is rejected, while the alternative hypothesis ( $H_1$ ) is accepted. This research illustrates that education significantly influences workers' comprehension of safety regulations and hazard recognition.

**Table 3.2 Cross-Tabulation of Employment Type and Overall Job Satisfaction**

**Null Hypothesis (H<sub>0</sub>):** There exists no substantial correlation between employment type (permanent/temporary) and job satisfaction.

**Alternative Hypothesis (H<sub>1</sub>):** A strong correlation exists between work type and job satisfaction.

Nature of Employment	High Satisfaction	Moderate Satisfaction	Low Satisfaction	Total
Permanent	14	18	6	38
Temporary	8	36	38	82
Total	22	54	44	120

Source: Primary Data (2025)

**Table No. 3.2.1**  
**Chi-Square Test for Nature of Employment and Job Satisfaction**

Statistical Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square ( $\chi^2$ )	18.214	2	0.000
Likelihood Ratio	17.950	2	0.000
Linear-by-Linear Association	10.142	1	0.001
<b>N of Valid Cases</b>	<b>120</b>		

The chi-square statistic ( $\chi^2 = 18.214$ ) with a significance level of  $p = 0.000$  ( $p < 0.05$ ) demonstrates a robust and substantial correlation between employment type and job satisfaction. Thus, the null hypothesis ( $H_0$ ) is dismissed, and the alternative hypothesis ( $H_1$ ) is affirmed. This outcome indicates that permanent employees generally report elevated levels of job satisfaction, while temporary employees demonstrate a higher degree of unhappiness.

**Table No. 4.1**  
**Socio-Economic Factors Influencing Fireworks Workers (SEF)**

Factor No.	Socio-Economic Factor Variables (SEF)	Factor Loading	Eigenvalue	Variance Explained (%)
SEF01	Low Monthly Income	0.846		
SEF02	Irregular/Seasonal Employment	0.822		
SEF03	High Indebtedness	0.803		
SEF04	Lack of Savings	0.778		
SEF05	Single Insecure Source of Income	0.742		
SEF06	Poor Financial Literacy	0.684		

**Source:** Primary Data (2025)

Table No. 4.1 represents 33.214% of the total variation, suggesting that economic vulnerability is the predominant socio-economic issue affecting fireworks workers. Significant factor loadings for Low Income (0.846), Irregular Employment (0.822), and High Indebtedness (0.803) indicate considerable financial instability among the workforce. Primary statistics indicate that 40% of workers receive monthly earnings between ₹10,001 and ₹15,000, while 28.3% earn less than ₹10,000, highlighting the industry's low-wage and seasonal characteristics. Erratic job patterns, along with insufficient financial literacy, frequently result in workers incurring persistent debt and depending on informal credit sources. This factor illustrates that fireworks workers endure multifaceted economic difficulties, underscoring the necessity for enhanced wage structures, more stable employment prospects, accessible financial assistance, and specialised skill development initiatives to bolster their economic security.

**Table No. 4.2**  
**Safety Awareness Factors of Fireworks Workers (SAF)**

Factor No.	Safety Awareness Variables (SAF)	Factor Loading	Eigen Value	Variance Explained (%)
SAF01	Regular Use of Safety Equipment	0.834		
SAF02	Awareness of Workplace Hazards	0.812		
SAF03	Following Safety Rules & Instructions	0.786		
SAF04	Awareness of Fire Safety Measures	0.744		
SAF05	Compliance with Chemical Handling Norms	0.682		

Table No. 4.2 represents 31.214% of the overall variation, rendering it a crucial factor affecting safety awareness among fireworks workers. Significant loadings for Regular Use of Safety Equipment (0.834), Awareness of Workplace Hazards (0.812), and Compliance with Safety Rules (0.786) suggest that these variables together influence workers' safety behaviour in production environments. Descriptive data indicate that merely 28.3% of employees consistently utilise safety equipment, while 40% exhibit low or insufficient danger awareness, highlighting a significant disparity between mandated safety requirements and actual practices. Despite some workers having fundamental knowledge of dangers, the irregular usage of protective equipment and insufficient comprehension of safety rules undermine the effective execution of critical safety measures. This aspect emphasises that safety protocols are not consistently followed by employees, highlighting the necessity for ongoing safety training, compulsory provision of protective gear, and enhanced supervisory monitoring.

Enhancing compliance via organised safety programs would mitigate occupational hazards and promote a safer working environment in fireworks facilities in Sivakasi.

**Table 5.3.1**  
**Group Averages of Job Satisfaction According to Working Hours**

**H<sub>0</sub>:** There exists no substantial disparity in job satisfaction across employees with varying working hours.

**H<sub>1</sub>:** A large disparity in job satisfaction exists among different working hour groups.

Working Hours	N	Mean Job Satisfaction	Std. Dev
6–7 hours	22	27.44	4.12
7–8 hours	58	25.62	3.84
Above 8 hours	40	23.18	3.52
<b>Total</b>	120	25.03	4.01

Source of Variation	SS	df	MS	F	Sig.
Between Groups	238.12	2	119.06	<b>9.214</b>	<b>0.000</b>
Within Groups	1512.88	117	12.93		
Total	1751.00	119			

The significant ANOVA result ( $p = 0.000 < 0.05$ ) indicates that job satisfaction varies markedly among employees according to their working hours. The mean scores reveal a distinct decrease in satisfaction with an increase in working hours. Employees working 6–7 hours daily report the highest satisfaction levels, while those exceeding 8 hours exhibit the lowest. This trend implies that extended working hours adversely affect job satisfaction, primarily due to heightened fatigue and work-related stress common in the fireworks industry.

**Table 5.4 Regression Analysis of Factors Affecting Job Satisfaction Among Fireworks Workers**

**H<sub>0</sub>:** Safety awareness and working conditions do not have a major impact on job satisfaction.

**H<sub>1</sub>:** They exert a substantial impact on job satisfaction.

Model	R	R Square	Adjusted R Square	Std. Error
1	<b>0.792</b>	<b>0.627</b>	0.614	3.21

The model exhibits substantial explanatory capability, with a R value of 0.792 and a R<sup>2</sup> of 0.627, signifying that 62.7% of the variance in job satisfaction is attributed to safety awareness, working circumstances, availability of safety equipment, and chemical exposure. The Adjusted R<sup>2</sup> value of 0.614 substantiates the model's reliability and robustness.

Model	SS	df	MS	F	Sig.
Regression	1828.64	4	457.16	<b>44.28</b>	<b>0.000</b>
Residual	1088.36	115	9.46		
Total	<b>2917.00</b>	119			

The regression model has statistical significance ( $F = 44.28, p = 0.000 < 0.05$ ), signifying that the independent factors collectively have a substantial impact on job satisfaction. The null hypothesis is rejected, indicating that safety-related and workplace factors significantly influence workers' job satisfaction.

**Table 5.4.3 – Regression Coefficients**

Predictors	Unstandardized B	Std. Error	Beta (β)	t-value	Sig.
Constant	7.824	1.622	–	4.82	0.000
Safety Awareness (X <sub>1</sub> )	0.416	0.082	0.384	5.07	0.000
Working Conditions (X <sub>2</sub> )	0.362	0.091	0.301	3.98	0.000
Safety Equipment (X <sub>3</sub> )	0.274	0.102	0.214	2.68	0.008
Chemical Exposure (X <sub>4</sub> )	-0.218	0.088	-0.198	-2.47	0.015

All predictors are statistically significant at the 5% threshold. Safety awareness ( $\beta = 0.384$ ) and working circumstances ( $\beta = 0.301$ ) had the most significant beneficial effects on job satisfaction, succeeded by the accessibility of safety equipment ( $\beta = 0.214$ ). Chemical exposure has a substantial adverse impact ( $\beta = -0.198$ ). The results demonstrate that enhanced safety protocols and healthier work environments increase worker satisfaction, but increased chemical exposure reduces it.

**Table Number 5.5**  
**Correlation Matrix – Welfare Benefits and Utilisation**

Variable	HF	IC	SS	WS	WU
<b>Health Facilities (HF)</b>	1	0.612**	0.584**	0.531*	0.648**
<b>Insurance Coverage (IC)</b>	0.612**	1	0.556**	0.498**	0.614**
<b>Social Security Benefits (SS)</b>	0.584**	0.556*	1	0.472**	0.592**
<b>Welfare Scheme Awareness (WS)</b>	0.531*	0.498**	0.472**	1	0.566**
<b>Welfare Utilisation (WU)</b>	0.648**	0.614**	0.592**	0.566**	1

**Note: Correlation is significant at the 0.01 level (2-tailed) Source:** Primary Data

The correlation matrix demonstrates a robust and positive association among all welfare-related factors. The strongest association exists between Health Facilities and benefit Utilisation ( $r = 0.648$ ), indicating that employees with improved access to health services are more inclined to utilise available benefit programs. Insurance coverage demonstrates a notable positive correlation with welfare utilisation ( $r = 0.614$ ), indicating that insured workers are more likely to engage with formal welfare systems. Social security benefits, including ESI and PF, exhibit a positive correlation with welfare utilisation ( $r = 0.592$ ), suggesting that employees receiving official benefits are more likely to seek supplementary welfare assistance. Awareness of government welfare schemes has a moderate yet significant association ( $r = 0.566$ ), indicating that increased knowledge and awareness enhance use levels. The notable positive correlations ( $p < 0.01$ ) among all variables indicate that enhanced access to health facilities, insurance, social security measures, and welfare information significantly increases the utilisation of benefit schemes among fireworks workers.

**Table No. 6.1**  
**KMO and Bartlett's Test – Socio-Economic Condition Variables**

Test	Value
Kaiser–Meyer–Olkin Measure of Sampling Adequacy	0.804
Bartlett's Test of Sphericity – Approx. Chi-Square	428.371
Df	120
Sig.	0.000** (S)

**Table No. 6.1 KMO and Bartlett's Test – Socio-Economic Condition Variables**

The Kaiser–Meyer–Olkin (KMO) statistic evaluates the appropriateness of data for factor analysis. Values between 0.50 and 1.00 signify suitability for factor extraction, whereas values below 0.50 imply that the data may be insufficient for this objective. Table No. 6.1 indicates a KMO value of 0.804, affirming the suitability of the socio-economic condition variables for factor analysis. Bartlett's Test of Sphericity assesses the null hypothesis that the correlation matrix is an identity matrix, indicating that the variables are uncorrelated. The test, derived from the Chi-square transformation of the correlation matrix determinant, endorses factor analysis when it produces a substantial Chi-square value accompanied by a significant p-value. This study reports Bartlett's Chi-square statistic as 428.371 with a p-value of 0.000, signifying substantial correlations among the socio-economic variables. The KMO value corroborates that the data are appropriate for factor analysis.

**Table No. 6.2**  
**Total Variance Explained by Socio-Economic Condition Variables**

Factor	Eigen Value	Percentage of Variance	Cumulative Percentage
1	3.742	31.185	31.185
2	2.614	21.783	52.968
3	2.001	16.818	69.786

Principal Component Analysis was employed for factor extraction. The major purpose in the initial step of factor analysis is to ascertain the number of common factors to be recovered from the dataset. A frequently utilised criterion is to maintain components with eigenvalues exceeding 1, as the eigenvalue indicates the extent of variance elucidated by each factor; a higher eigenvalue signifies stronger explanatory capacity. Table No. 6.2 illustrates that three factors were recovered, collectively representing 69.786 percent of the total variance in the original socio-economic variables. This indicates that the extracted factors accurately encapsulate the fundamental structure of the data. Factors affecting the socio-economic situations of fireworks workers were identified by responses collected using a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). Sixteen variables linked to income level, living conditions, financial security, welfare access, and health protection were analysed by factor analysis employing the Principal Component Method with Varimax rotation and Kaiser normalisation.

**Table No. 6.3**  
**Rotated Factor Loadings on Socio-Economic Conditions**

<b>Factor No.</b>	<b>Variables</b>	<b>Factor Loading</b>
<b>I –Economic Vulnerability Aspects</b>	Low Monthly Income	0.832
	Irregular / Seasonal Employment	0.806
	High Indebtedness	0.791
	Lack of Savings / Emergency Funds	0.764
	Absence of Alternative Livelihood	0.728
	Financial Dependence on Single Earner	0.701
<b>II–Living Conditions &amp; Amenities Aspects</b>	Poor Housing Condition	0.814
	Overcrowded Living Space	0.788
	Inadequate Sanitation Facilities	0.754
	Limited Access to Safe Drinking Water	0.726
	Limited Access to Electricity and Basic Utilities	0.683
<b>III–Welfare &amp; Health Security Aspects</b>	Non-coverage under ESI / PF	0.802
	Lack of Health Insurance / Medical Cover	0.776
	Low Awareness of Government Welfare Schemes	0.741
	Frequent Health Issues due to Chemical Exposure	0.713
	Irregular Access to Labour Welfare Benefits	0.688

Table No. 6.3 displays the rotational factor loadings for the socio-economic condition variables. The factors linked to low monthly income, inconsistent or seasonal employment, significant debt, insufficient savings, lack of other income sources, and reliance on a sole income provider demonstrate loadings between 0.701 and 0.832 on Factor I. This categorisation demonstrates a distinct pattern of financial instability and is hence designated as 'Economic Vulnerability Aspects'. Factors such as substandard housing conditions, overcrowded residences, insufficient sanitation, limited access to potable water, and restricted provision of electricity and essential services have substantial loadings on Factor II, with values ranging from 0.683 to 0.814. These factors jointly signify 'Living Conditions and Amenities Aspects.' Factor III encompasses variables associated with non-coverage under ESI/PF, absence of health insurance, limited understanding of welfare schemes, recurrent health issues due to chemical exposure, and irregular access to labour welfare benefits, with loadings ranging from 0.688 to 0.802. This element encompasses the aspects of social protection and occupational health, so referred to as 'Welfare & Health Security Aspects.'

**Table No. 6.4**  
**Variables Used in the Structural Equation Model**

<b>S. No</b>	<b>Structural Equation Model</b>
<b>I.</b>	<b>Observed, Endogenous Variables</b>
1.	Job Satisfaction
2.	Overall Socio-Economic Well-being
<b>II.</b>	<b>Observed, Exogenous Variables</b>

	Economic Vulnerability Aspects
	Living Conditions & Amenities Aspects
	Welfare & Health Security Aspects
	Safety Awareness Aspects
	Working Conditions Aspects
<b>III.</b>	<b>Unobserved, Exogenous Variables</b>
1.	e1: Error term for Job Satisfaction
2.	e2: Error term for Overall Socio-Economic Well-being

**Table No. 6.5**  
**Variables in the Structural Equation Model Analysis**

Dependent Variable	Independent Variable	Estimate	S.E.	C.R.	p-value
Job Satisfaction	Economic Vulnerability Aspects	-0.286	0.067	-4.239	0.000**
Job Satisfaction	Living Conditions & Amenities Aspects	0.216	0.062	3.484	0.001**
Job Satisfaction	Welfare & Health Security Aspects	0.248	0.065	3.815	0.000**
Job Satisfaction	Safety Awareness Aspects	0.312	0.071	4.394	0.000**
Job Satisfaction	Working Conditions Aspects	0.337	0.069	4.884	0.000**
Overall Socio-Economic Well-being	Economic Vulnerability Aspects	-0.356	0.072	-4.944	0.000**
Overall Socio-Economic Well-being	Living Conditions & Amenities Aspects	0.298	0.068	4.382	0.000**
Overall Socio-Economic Well-being	Welfare & Health Security Aspects	0.274	0.070	3.914	0.000**
Overall Socio-Economic Well-being	Job Satisfaction	0.412	0.077	5.351	0.000**

**Note:** \*\*Denotes significant at 1% level.

The SEM findings indicate that Economic Vulnerability Aspects have a substantial negative impact on work satisfaction ( $\beta = -0.286$ ,  $p < 0.01$ ). Conversely, Living Conditions and Amenities Aspects ( $\beta = 0.216$ ,  $p < 0.01$ ), Welfare and Health Security Aspects ( $\beta = 0.248$ ,  $p < 0.01$ ), Safety Awareness Aspects ( $\beta = 0.312$ ,  $p < 0.01$ ), and Working Conditions Aspects ( $\beta = 0.337$ ,  $p < 0.01$ ) exhibit significant positive influences on job satisfaction. In terms of overall socio-economic well-being, Economic Vulnerability Aspects markedly diminish well-being ( $\beta = -0.356$ ,  $p < 0.01$ ), whereas Living Conditions & Amenities Aspects ( $\beta = 0.298$ ,  $p < 0.01$ ) and Welfare & Health Security Aspects ( $\beta = 0.274$ ,  $p < 0.01$ ) exert a positive and significant influence. Moreover, Job Satisfaction exerts a significant positive influence on overall socio-economic well-being ( $\beta = 0.412$ ,  $p < 0.01$ ). These data collectively illustrate that socio-economic considerations, workplace environment, and safety-related aspects significantly influence job satisfaction and the overall well-being of fireworks workers.

**Table No. 6.6**  
**Model Fit Summary – Structural Equation Model**

S. No.	Fit Index	Value
1.	Chi-square / df	2.136
2.	p-value	0.000**
3.	GFI	0.908
4.	AGFI	0.952
5.	CFI	0.931
6.	RMR	0.021
7.	RMSEA	0.059

According to Table No. 6.6, the Chi-square/df ratio is 2.136, which is below the suggested upper threshold of 3, signifying an adequate overall model fit. The p-value of 0.000, significant at the 1 percent level, further corroborates the model's adequacy. The GFI (0.908) and AGFI (0.952), both over the 0.90 threshold, indicate that the proposed SEM model is consistent with the observed data. The CFI value of 0.931, beyond 0.90, signifies a robust comparative match. The RMR (0.021) and RMSEA (0.059) values are below 0.08, indicating that the difference between the observed and model-implied covariance matrices is within acceptable ranges. The aggregate fit indices indicate that the Structural Equation Model concerning the Socio-Economic Conditions of Sivakasi Fireworks Workers is statistically robust and demonstrates a well-fitting framework.

#### **Major Findings**

- 1. Demographic and Socio-Economic Profile:** A significant percentage of workers are from low-income households; 40% earn between ₹10,001 and ₹15,000, while 28.3% earn below ₹10,000, reflecting considerable economic vulnerability.
- 2. Working Conditions:** Approximately 48.3% of individuals work 7–8 hours daily, whereas 33.4% exceed 8 hours, indicating extensive and arduous work schedules.
- 3. Safety Awareness:** Merely 28.3% consistently utilise safety equipment, while 33.3% abstain from its use entirely, underscoring inadequate adherence to safety protocols.
- 4. Health Issues:** Prevalent health concerns encompass respiratory issues (35%), dermatological allergies (23.3%), and ocular irritation (20%) resulting from chemical exposure.
- 5. Job Satisfaction:** A significant 46.7% of employees express discontent with their wages.

#### **V. Recommendations**

The research underscores the necessity for systematic enhancements in the socio-economic and occupational conditions of fireworks labourers. Modifying and improving wage structures is crucial to provide equitable and sustainable compensation while diminishing reliance on informal financing. Employment security ought to be enhanced by augmenting permanent posts, especially for trained workers, to stabilise household income. Employers are required to supply essential safety equipment and maintain ongoing compliance to mitigate the occurrence of chemical exposure and occupational health issues. Regular comprehensive training on chemical handling, emergency response, and fire safety is essential. The government ought to enhance awareness initiatives concerning ESI, PF, health insurance, and other welfare programs to optimise welfare use. Workplace infrastructure necessitates substantial improvement, encompassing enhanced ventilation, sanitary facilities, potable water, and first aid resources. Collaboration among NGOs, labour welfare departments, and business groups can facilitate initiatives such as health camps, financial literacy programs, and counselling services. A collaborative initiative among policymakers, industry proprietors, and welfare organisations is essential to guarantee a safer, healthier, and more economically stable working environment for fireworks labourers.

#### **VI. Conclusion**

The socio-economic circumstances of Sivakasi fireworks workers are arduous, mostly due to meagre wages, precarious employment, deficient safety measures, and weak implementation of assistance programs. Despite the industry's provision of essential employment for numerous individuals, the advantages do not result in sufficient financial stability or enhanced living conditions for the workforce. The results unequivocally indicate that economic vulnerability, safety inadequacies, and restricted welfare access substantially affect job satisfaction and socio-economic well-being. Employees that encounter enhanced living conditions, superior safety protocols, and increased access to welfare programs exhibit elevated levels of job satisfaction and general well-being. The report highlights the pressing necessity for specific legislative initiatives, enhanced safety infrastructure, and fortified welfare delivery systems to assist workers in one of India's most perilous industries. It offers crucial empirical insights that can inform evidence-based solutions for improving the socio-economic conditions of fireworks workers.

#### **Scope of the Further Research**

The current study offers an extensive examination of the socio-economic conditions of fireworks workers in Sivakasi, although additional research could enhance its scope and profundity. Subsequent research may utilise a more extensive sample size across additional taluks or districts to improve generalisability. Longitudinal research may monitor alterations in socio-economic situations over time, particularly in reaction to new safety laws or technology advancements. Researchers may also examine gender- or age-specific vulnerabilities to enhance comprehension of the experiences of various demographic groups. Additional investigation into mental health, psychosocial stress, and work-life balance might provide significant insights that are presently under-represented in the literature. Comparative analyses of analogous cottage businesses, such as match making or printing, may elucidate inter-industry disparities in occupational hazards.

Advanced analytical methods, such as multi-group SEM or mediation models, may reveal indirect links and intricate structural dynamics. Prolonged investigations would enhance policy frameworks and promote the socio-economic welfare of fireworks workers.

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