**RESEARCH PAPER**

# Prioritizing Occupational Stress Determinants among Indian Police Using Delphi-Based Intuitionistic Fuzzy AHP

**S.Rajaprakash[1], ChanBagath basha[2], M. Ramadhevi[3] and Pankaj Kumar[4]**

*[1]Department of computer science and Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, India*
*[2]Kommuri Pratap Reddy Institute of Technology, Autonomous, Hyderabad, Telangana, India*
*[3]Department of Information Science and Engineering, Meenashi College of Engineering, Chennai, India*
*[4]Department of Information Science and Engineering, Acharya Institute of Technology, Bangalore,India*
*[1]srajaprakash_04@yahoo.com , [2]chan.bagath@gmail.com, [3]ramadhevi.ss@gmail.com and [4]pankaj.john11@gmail.com*

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**ABSTRACT**
In the current situation, Indian police experience a lot of stress, which leads to biological changes. This contributes to various lifestyle disorders, including heart disease, chronic fatigue syndrome, backaches, and insomnia. According to the Ministry of Home Affairs, 166 police officers in Tamil Nadu committed suicide between 2010 and 2014. The problem is especially high in India. We analyze the stress factors, but it is very difficult to identify the most affected ones, as this involves multiple criteria. To address this issue, this work aims to determine the stress factors among police forces at various levels using the analytical hierarchy process (AHP), along with intuitionistic sets and the Delphi method. It considers a set of evaluation criteria with alternative options to find the best solutions for the problem. To handle the uncertain situations, intuitionistic fuzzy sets will produce the best outputs, and data are generated with the help of the Delphi method.

**Keywords:** stress, uniform force stress, intuitionistic fuzzy set, AHP

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## 1. INTRODUCTION

Police officers' exposure to the public and the fact that they spend most of the day working with different kind of people will have lot of stress because they are dealing people with higher crime rate. Police are responsible for safeguarding the lives of citizens. They must have strong emotional control under pressure, in unclear situations, and while working at a faster or different speed. They are also accountable for any weapons they may possess. Based on the survey, the 41 % police officers are found to be in stress due to the work environment of their jobs. Each and every man and women in the society is affected by one or a different kind of stress in their life [3]. The job's operational and organizational responsibilities are among the sources of stress. The operational tasks are community services, patrol activities, traffic control, crime prevention, and criminal investigations. The organizational tasks are public information, record keeping, shift distribution, schedules, and bureaucratic procedures. The cost of stress is affecting the police officers health. Police officers suffer from physical disorders and emotive troubles. Police officers physical health affected such as cardiovascular diseases, stomach troubles, sleep disorders; and emotive troubles such as depression, anxiety, panic attacks, and flashbacks. There are several reasons why police officers experience stress at work: First, there is the evident inherent risk, which is related to employment risk and danger. Second, there is the administrative structure of the police, which includes a lack of compensation, high demands, and job insecurity. Third the lack of organizational support.Police officers have more stress problems such as low self-esteem, inability to do a better job, loss of appetite and mood swings, resulting in unimportant work, anger at the slightest provocation and creating problems in the family as well. as in society. A police officer's job plays a very important role in controlling the traffic system and addresses the safety of the citizens of society in a very responsible way. More cars and more traffic lead to air pollution. Traffic duty is a very difficult job to cope with this mentally and physically demanding job. Traffic police officers, especially female police officers, have a hard time balancing work because they continue to work during the summer and rainy season. and stress is a major factor that inhibits activity. It is also bad for your health. Transportation service is a very dangerous job that causes stress due to long working hours, irregular eating habits, irritability, negative attitudes from civil servants and officials, insomnia, gender discrimination, etc.

**Author for Correspondence: srajaprakash_04@yahoo.com*

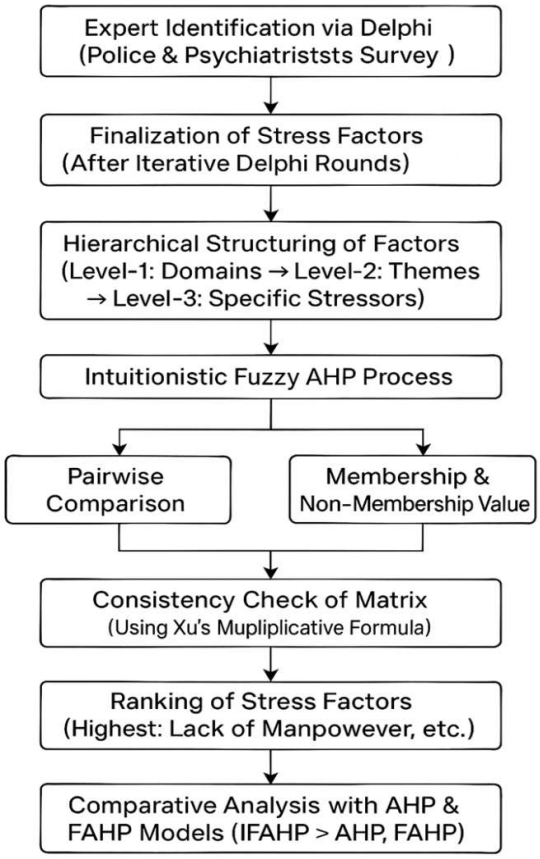


**Figure-1** Graphical Abstract

### 1.1. Fuzzy Set

The vague data represented by qualitative or quantitative in mathematical model. The fuzzy set generalization of classical set with the concept of its characteristic function. All the crisp value converted between 0 to 1 using function which is known as membership function.

### 1.2. Intuitionistic Fuzzy Set (Ifs)

The degree of membership and the degree of non-membership are more or less independent of one another in a "higher-order fuzzy set called the IFS". The sum of these two frequencies must not be greater than one, which is the only criterion. The application of higher-order fuzzy sets makes the solution more complex, but consider that you would get better results today if the computational time, computational complexity, and memory space complexity were not equal. Agarwal and others We introduced a fuzzy rule-based probabilistic and logical controller design.

### 1.3. Membership Function

A fuzzy set's membership function encompasses all of its characteristics. Every fuzzy set has a discourse universe X that is made up of the real line R. It is not feasible to define every membership function type.

Using the mathematical formula we can have concise way to define membership function. Most commonly we can define three types of membership functions as given below.

## 2. PAST WORK

### 2.1. IFAHP

In 1986 Atanassov presented the idea of IFS as a generalisation of fuzzy sets. The degree of non-membership is a new element that the scientist introduced to the concept of a fuzzy set. In 1996, P. Burillo et al. it was investigated whether one could create an IFS from two fuzzy sets, which is one of his two theorems of IFS. The recovery of fuzzy sets utilised in building from Intuitionistic fuzzy sets was also covered by the authors. Intuitionistic Fuzzy Pairs, Indus Fuzzy Pairs, and Intuitionistic Fuzzy Values were published by his Krassimir Atanassov et al. however the new concept of the distance between two Intuitionistic fuzzy sets differs from that of Elualia Szmidt et al. 2013. Using an Intuitionistic fuzzy Delphi technique, forecasts are made using advice from experts. Tapan Kumar et alproposed .'s aggregation method uses triangular fuzzy numbers and is based on expert judgement. Deschrijver et al. developed the idea of Intuitionistic fuzzy t-norms and t-connorms in 2002. The Intuitionist Fuzzy his Triangle His norm was proposed by Xu et al in 2007. Eulalia Szmidt et al. in 2001 explored the application of IFS as a diagnostic tool for disease D based on symptoms S. An assortment of symptoms served as the author's database for this piece. The measure in this study and that of Eulalia et al. (2000) is compatible with typical fuzzy sets. An intuitionistic fuzzy system for managing heating fans was created using IF logic. In this study, the heater fan speed is determined by applying IF rules to an inference engine utilising

Muhamman Akram et aldefuzzification .'s method from 2013.

In 2025, Aichevarya Devi et al. Proposed a unique decision-making framework that integrated photo fuzzy units, EDAS, the Best-Worst Method, and Dempster-Shafer idea to assess COVID-19 trying out kits. In the same 12 months, Sumrit et al. Tested how big statistics analytics skills make a contribution to enhancing healthcare supply chain resilience using a hybrid spherical fuzzy MCDM model. Dincer et al. (2024) developed an AI-supported fuzzy choice-making method employing quantum image fuzzy rough sets and M-SWARA for assessing power transition technology. Muthunandhini et al. (2025) added a T-spherical fuzzy framework with a triple vague structure to prioritize industries based totally on their roles in successive commercial revolutions. Debnath et al. (2024) applied a Grey DEMATEL approach to analyze the interconnected challenges impeding sustainable manufacturing practices in Bangladesh's garb manufacturing zone. Parthasarathy et al. (2024) proposed an greater IDOCRIW-COCOSO version the usage of q-rung orthopair picture fuzzy sets to aid the choice of greatest electric powered automobile battery recycling methods. Lastly, Jafarzadeh Ghoushchi et al. (2024) offered a hybrid MCDM approach combining F-LMAW and Fermatean fuzzy WASPAS to optimize the efficiency of linked independent motors through the mixing of augmented intelligence and IoT.

**2.2 Police Stress**

Using intuitionistic fuzzy set theory, Tamalika Chaira (2010) extracted various types of regions from a remotely sensed image. The new extracted image using IFS were better because of the hesitation degree, according to the author's comparison of fuzzy and non-fuzzy methods in his work. G conducted research on how to predict students' performance using an Intuitionistic fuzzy set. Vasanthi measured the distance between each student's performance in each subject area in "2015 and in her work using the normalized Euclidean distance method", respectively. Lazim Abdullah and colleagues used IFAHP to simultaneously assess the four essential variables of the Human capital indicator in their study of capital indicator and ranking. Dr.Beulah Shekhar MS University studies stress factors in Tamil Nadu police. He assessed psychological factors such as stress, secondary traumatic stress, aggression, and suicidal ideation as well as "organizational climate, job satisfaction, and professionalism to the performance of sub-inspectors" in his 31 Tamil Nadu Police Districts. It discusses social factors, including engagement. In his work, the author identified 21 attributes and analyzed the collected data using the chi-square test. In 2013, M. Sekar et al. The stressor of the Chief of Police in Tamil Nadu. The authors collected data from 200 police officers (Grade III) belonging to 52 police stations in Tuticorin District, Tamil Nadu. He identified his 44 attributes of stressors in his research. Researchers applied descriptive analysis, factor analysis, weighted averages, and chi-square for data analysis. 2015, C. Mohanraj et al. conducted a study on stress and "job satisfaction" among female "police officers in Coimbatore, Tamil Nadu". In her book, the author discussed the stress and "job satisfaction of female police officers working in Coimbatore district, Tamil Nadu". A sample of 240 individuals were selected by multilevel her sampling, responses were collected using a questionnaire method, and we concluded that police officer stress was negatively correlated with job satisfaction in the year 2015 by HakanBatuhankara et al. We examined differences in pre-existing stressors for police in developed and developing countries. The authors compare the stressors of the Turkish National Police (TNP) and US law enforcement agencies. Finally, the authors conclude that there are no major stressor differences between law enforcement agencies in the two countries. 2018 Jessica C.M. Li et al. conducted a study on the family factors of job stress and involvement among police officers in Hong Kong. His study used multivariate regression to assess the impact of demands and resources on job stress and job engagement, based on his randomized sample of 514 male and female police officers conducted. The final findings of his study were that there was a positive correlation with job stress and a negative correlation with job engagement. In 2018, Waqar Husain et al. Depression, Anxiety, and Stress, researched by police departments and police officers in police departments around the world. The author's research included his 315 police officers in his three major districts in a state that was largely uninvestigated. The authors ultimately conclude that police officers working in high-class police stations have higher levels of depression, anxiety, and stress compared to those working in low-class police stations. Much work was done early on to identify the stressors of policing, and her 25–35 stress traits that influence policing were also identified. In 2019, Chatterjee and Rani began utilizing intuitionistic fuzzy AHP to analyze the stress factors experienced by law enforcement professionals. They used intuitionistic fuzzy sets to solve issues arising from human judgment that involved capturing both membership and non-membership degrees, thus allowing for the identification and ranking of stressors in a much more robust manner. In 2020 Gupta and Mehta put forth fuzzy decision making models designed to meet the contemporary needs of policing. Through a case study, they used fuzzy logic to deal with ambiguous and imprecise information and showed that these models can greatly improve risk assessment and resource allocation in the rapidly changing environment of law enforcement. In 2021[3], Singh and Kumar presented a paper on the contemporary practices of police stress management by using an intuitionistic fuzzy approach. Their study highlighted that stress factors can analyzed with membership and non-membership values as well as hesitation degrees and would lead to better outcomes as compared to other methods. In 2022[4], Patel and Desai suggested the allocation of police resources in stressful

work environments and decision making using the fuzzy Analytic Hierarchy Process. They prioritized the most important resource in police work, such as personnel and equipment, so as to make police work more efficient and responsive.

**Table 1.** Gap Analysis

| Reference (Year) | Contribution/Focus | Shortcomings/Gaps | Relevance to This Work |
|---|---|---|---|
| Chatterjee & Rani (2019)[18] | Used intuitionistic fuzzy system to analyze stress factors.. | Data consistency not clear and lack integration with other methods | Helps as a initial model that this work aims to improve by combination of methodologies. |
| Gupta & Mehta (2020)[19] | Fuzzy decision model was developed to modern policing challenges. | Highlighted decision-making only not detailed study about stress factor prioritization. | Updates aspects of source allocation and managerial in high-stress policing contexts. |
| Singh & Kumar (2021)[20] | Reviewed trends in police stress management using intuitionistic fuzzy methods. | Focused on general trends without offering an integrated assessment framework. | Provides insights into modern fuzzy approaches for stress management. |
| Patel & Desai (2022)[21] | Optimized police resource allocation under stress using fuzzy AHP. | Concentrated on resource allocation; did not fully address comprehensive stress analysis. | Supports the operational side of stress management, contributing to resource optimization strategies. |
| Li & Zhang (2023)[22] | More nuanced fuzzy set methodology to improve police work productivity. | More concerned with the theory than with defining the sources of stress and focusing on them. | Presents a framework with novel fuzzy approaches for analysis and optimization of police work under stress. |
| Gap Summary | Like all fuzzy studies, they are well grounded in theory. However, police stress research is mostly conventional. More recent studies are using fuzzy methods in policing. | None of them apply an Intutionistic Fuzzy AHP combined with the Delphi method for the analysis of police stressors factors. | This paper integrates fuzzy analytical models and expert judgment to tackle that problem by systematically and hierarchically evaluating police stressors. |

## 3. METHODOLOGY

This work employs the IFAHP triangle membership function. It combines AHP with the Intuitionistic Fuzzy Set. When compared to FAHP, Intuitionistic fuzzy set theory produces very good results on fuzziness.The IFAHP with Delphi technique comprised the following phases.

**Step.1: Delphi Method**

- Create a questionnaire based on suggestions from relevant local police officers and psychiatrists. Take the opinion from the Police officers and psychiatrists for the questionnaire.
- Calculate the average opinion of police officers and psychiatrists. For each attribute, compute the mean and the difference between the values for police officers and psychiatrists.
- If the deviation is too high, the question is sent back to the police officer and psychiatrist for rescoring. This process continues until two consecutive values become very small or the police and psychiatrist are satisfied.

**Step.2: Comparison Matrix**

After finalized the values from Delphi method, the comparison matrix are framed.

**Step-3: Relation of Intuitionistic set**

To check consistency based on the intuitionistic preference relationship by Xu et al[10]. The consistent interval fuzzy preference relation is:

R= $(M_{lm})_{nxn}$ with $M_{lm}=(\mu_{lm},\nu_{lm})$ ( l, m= 1,2,3…n) is multiplicative consistent if

$$\mu_{lm}=\begin{cases}0\ , & if\ (\mu_{lo}\ ,\mu_{om})\in\{(0,1),(1,0)\}\\ \dfrac{\mu_{lo}\mu_{om}}{\mu_{lo}\ ,\mu_{om}+(1-\mu_{lo})(1-\mu_{om})}, & otherwise\end{cases} \quad [1]$$

$$\nu_{lm}=\begin{cases}0\ , & if\ (\nu_{lo}\ ,\nu_{om})\in\{(0,1),(1,0)\}\\ \dfrac{\nu_{lo}\nu_{om}}{\nu_{lo}\ ,\nu_{om}+(1-\nu_{lo})(1-\nu_{om})}, & otherwise\end{cases}$$

By proving the fuzzy preference relation, Xia and Xu. The following statements are identical in the fuzzy preference relation [Xe]:

$$b_{lm}=\frac{\sqrt[n]{\prod_{s=1}^{n}b_{lp}b_{pm}}}{\sqrt[n]{\prod_{p=1}^{n}b_{lp}b_{pm}}+\sqrt[n]{\prod_{p=1}^{n}(1-b_{lp})(1-b_{pm})}}\ l,m=1,2,3...n \quad [2]$$

Based on the above results and theorem, Zeshuri Xu et al. We developed two algorithms in " Intuitionistic Fuzzy Hierarchical Analysis Process". However, only one algorithm was used. Based on this algorithm, the following formula can be written:

For m > l+1, and let $\overline{M}_{lm}=(\overline{\mu}_{lm},\overline{\nu}_{om})$ where

$$\overline{\mu}_{lm}=\frac{\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}\mu_{lo}\mu_{om}}}{\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}\mu_{lo}\mu_{om}}+\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}(1-\mu_{lo})(1-\mu_{om})}}\quad m>l+1 \quad [3]$$

$$\overline{\nu}_{lm}=\frac{\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}\nu_{lo}\nu_{om}}}{\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}\nu_{lo}\nu_{om}}+\sqrt[m-l-1]{\prod_{o=l+1}^{m-1}(1-\nu_{lo})(1-\nu_{om})}}\quad m>l+1 \quad [4]$$

And for m= l+1 let $\overline{M}_{lm}=M_{lm}$ and m<l let $\overline{M}_{lm}=(\overline{\nu}_{ml},\overline{\mu}_{ml})$ .The values of the lower triangular elements of the matrix and the preceding equations yield a multiplicative consistent intuitionistic relation.

**Step-4: Consistence Check**

The following formula is used to determine how far intuitionistic relations are from one another:

$$d(\overline{M},M)=\frac{1}{2(n-1)(n-2)}\sum_{l=1}^{n}\sum_{m=1}^{n}(|\overline{\mu}_{lm}-\mu_{lm}|+|\overline{\nu}_{lm}-\nu_{lm}|+|\overline{\pi}_{lm}-\pi_{lm}|) \quad [5]$$

If $d(\overline{M},M)<\tau$ [6]

Then the relationship matrix is consistent in the Intuitionistic relationship. Here $\tau$ is the consistency threshold, if the hypothesis does not satisfy Equation (6), that is, the Intuitionistic preference relationship is inconsistent, then go to step 1

**Step-5: Weight Calculation**

The following formula is used to determine the precedence of the intuitionistic preference relation (zeshuriXu).

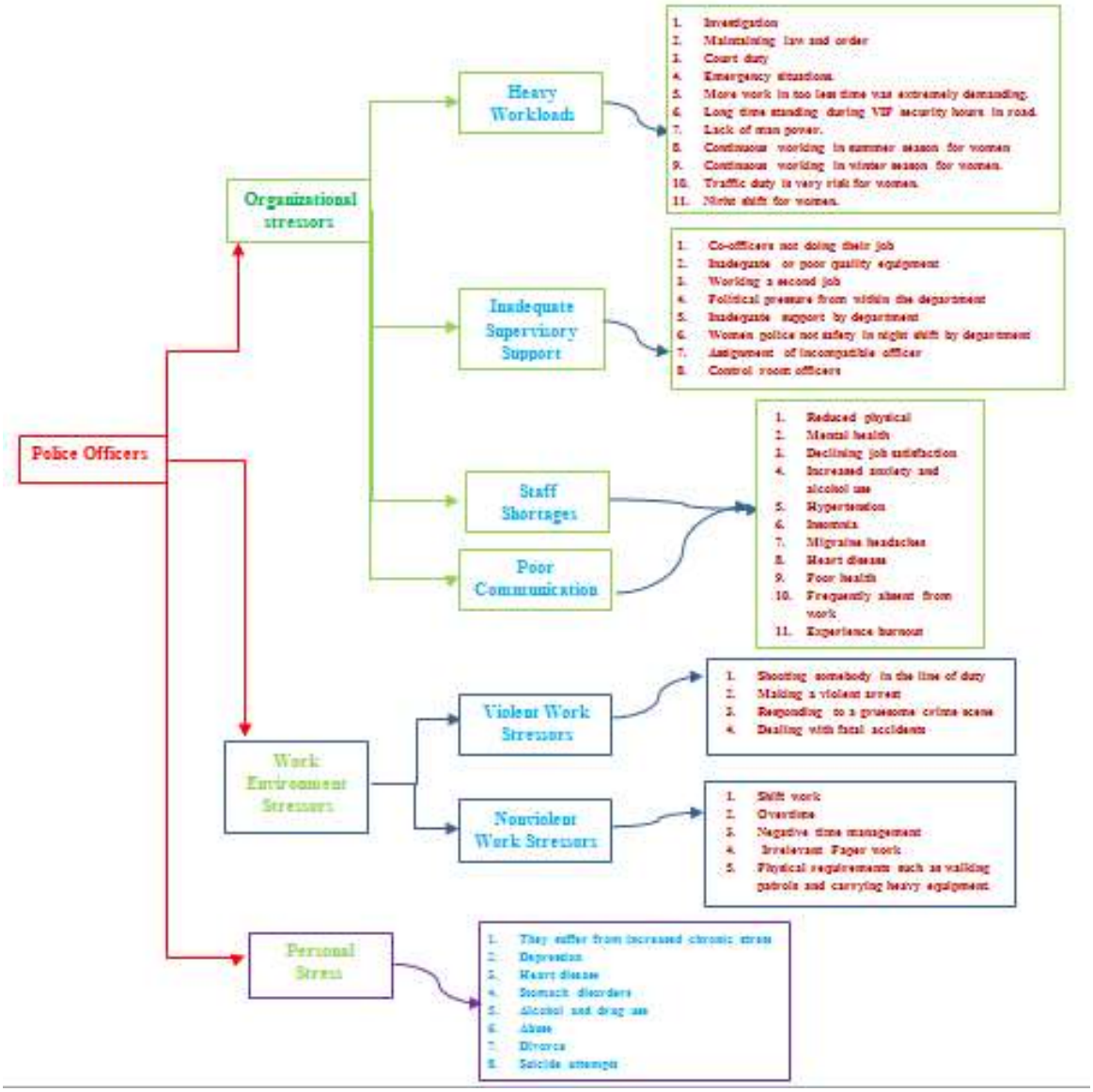


**Figure-2:** Hierarchy of Police Stress Factors

$$w_l = \frac{\sum_{m=1}^{n} M_{lm}^{1}}{\sum_{l=1}^{n}\sum_{m=1}^{n} M_{lm}^{1}} = \frac{\sum_{m=1}^{n}[\mu_{lm}, 1-\nu_{lm}]}{\sum_{l=1}^{n}\sum_{m=1}^{n}[\mu_{lm}, 1-\nu_{lm}]}, w_l = \left( \frac{\sum_{m=1}^{n}[\mu_{lm}]}{\sum_{l=1}^{n}\sum_{m=1}^{n}[1-\nu_{lm}]}, 1 - \frac{\sum_{m=1}^{n}[1-\nu_{lm}]}{\sum_{l=1}^{n}\sum_{m=1}^{n}[\mu_{lm}]} \right) \quad [7]$$

By mathematical form of Szmidt and Kacprzyk

$$\rho(\alpha) = 0.5(1+\pi_\alpha)(1+\mu_\alpha) \quad [8]$$

**Step-6: Preference Ranking**

Equation [8] is used to compute the value after determining the weight of the equation. We may quickly order the preference (rank) of the qualities based on this value.

### 3.1. Implementation:

#### 3.1.1. Observation

**Heavy workloads:** Response rates are good for serious crime. Crime problems are concentrated. Resources for responding to CFS have declined. Officers regularly work extra hours to deal with personnel shortfalls on special event days: they work on days off or work extended regular shifts.

**Inadequate supervisory support:**

**Supervision of the activities of police** :For three main reasons, it can be exceedingly difficult to oversee police personnel' activities. Patrol officers, state police, and control room personnel.

**Police on patrol:** The first is that uniformed cops are mobile, scattered throughout a large geographic region, and typically patrol alone or in pairs. For instance, in large-city police forces, a sergeant may be in charge of managing up to twelve patrol officers who are scattered over a 12-square-mile region and each patrolling on their own.

**State Police Agencies:** Less officers may be under the command of sergeants in state police or sheriff departments, but these officers may be scattered over even wider geographical areas, such as one or more counties.

**Control Room Officers:** Uniformed police are typically free to roam at random while responding to calls in an effort to spot criminal activity and serve as a visible deterrent to crime. As a result, when they are not responding to a need for assistance, subordinate officers can be hard to find for a sergeant to personally watch their behaviour.

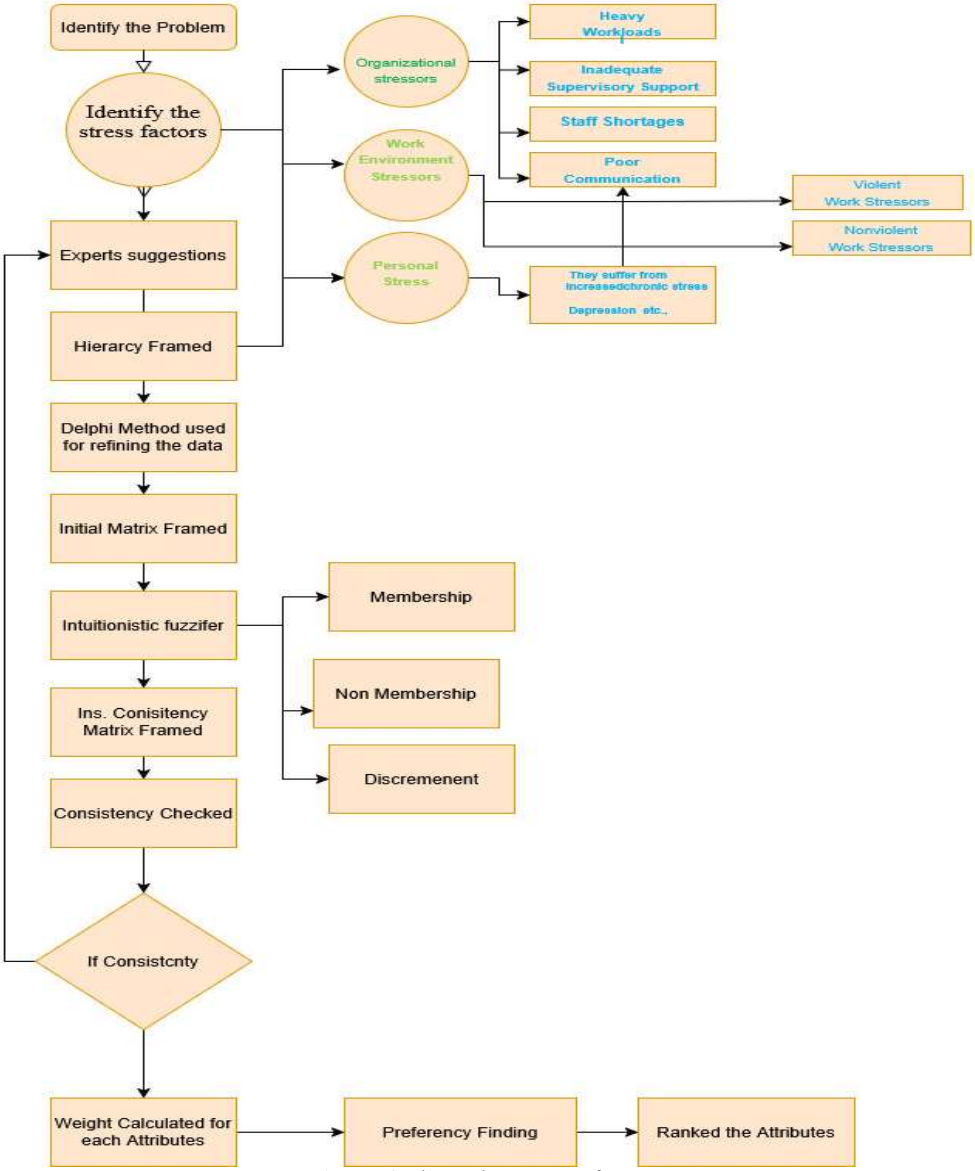


**Figure-3** Flow Chart Stress factors

**Staff shortages**
When some extremely effective officers filed letters of resignation, citing personal reasons such as raising children, going back to school, or seeking opportunities for personal development, it added to the department's stress. They did not want to leave the police force, but they found it difficult to combine their professional and personal lives while serving as full-time policemen. Compared to immediate operational pressures like attending accident sites and apprehending aggressive suspects, poor communication is much more common and problematic. Reduced physical, mental, and job satisfaction, increased anxiety and alcohol usage, hypertension, insomnia, migraine headaches, heart disease, and poor health are among the issues that have an impact on police careers. Burnout, being frequently absent from work, and being dissatisfied with their jobs.

Several work environment stressors: Shooting someone while doing your job duties, making a violent arrest, attending a grisly crime scene, and dealing with fatal accidents are all examples of violent behaviour.

Nonviolent work: Shift work, overtime, poor time management, paperwork, and physical demands including lugging heavy equipment and walking patrols are related pressures.

Police officers body affected by Personal Stress : They have higher levels of chronic stress, depression, heart illness, stomach diseases, abuse of alcohol and other drugs, divorce, and attempted suicide. Organizational stressors are divided into four categories, including a lack of supervisory backing

Staff Shortages, Poor Communication, in that Heavy Workloads are categories in to thirteen sub classes. Here these attributes are compared based on the experts suggestion of Delphi method first comparison matrix are framed.

**Level -1: Large tension categories**
These broad categories include different types of tension affecting police officers.

**1. Organizational stress**
This tension arises from questions related to administrative and management in the police force.

Disability, poor communication and lack of supervisory support contribute to the stress of officers.

Officers often feel very high due to lack of employees and excessive paperwork.

**2. Work atmosphere stress**
These include physical and psychological challenges in daily police tasks. Crime, long working hours and exposure to irregular changes are tired. Dangerous conditions, high pressure and operating difficulties decisions affect their mental good.

**3. Individual stress**
This is tension at the individual level that affects the physical and emotional health of police officers.

Long -lasting stress increases the risk of anxiety, depression and diseases. Relationship problems, drugs and suicide trends are common results

**Level -2: Upcreeies of stress factors**
Each tension category consists of specific challenges that affect police officers.

**1. Insufficient supervisory support**
Officers often lack the right guidance from observers because of the police's decentralized nature.A single observer may be responsible for several officers in different fields, which reduces the overview. Lack of support leads to confusion, frustration and mistakes in the decision.

**2. Heavy charge**
Police officers often work overtime due to crime investigations and administrative work. Managing large cashlides, responding to emergencies and driving patrols increases the stress. Inability to take a brake or relax contains mental and physical fatigue.

**3. Lack of employees**
Due to dismissal, promotion and transfer, many departments suffer from insufficient personnel.

Officers should be taken to further duties and causes imbalance in working life and excessive fatigue.

Lack of backup in critical conditions increases the risk and delays emergency reactions.

**4. Poor communication**
Sensitive or vague communication between officers and command centers can lead to errors.

During operations, misunderstandings can threaten officers and citizens.

Lack of clear guidelines or delayed reactions improves disappointment and operating difficulties.

**Level -3: Specific stress factor**
These are detailed questions that police officers face, ranked seriously.

1. Investigation Officers handle complex criminal investigations that require the collection of extensive evidence. Legal procedures, suspected inquiries and case documentation increase the pressure. Sleep spent on solving crimes for a long time and mental fatigue.

**2. Maintain law and order**
Officers should often handle protests, riots and major public functions facing enmity They are responsible for maintaining discipline and ensuring public security by implementing laws.Taking tension with aggressive individuals and unexpected overload causes stress.

**3. Law tax**
Officers often appear in court to testify, sometimes under intensive investigation.They should remember and document cases accurately, which require considerable mental efforts.Expanded court proceedings interfere with regular patrol tasks and increase the charges.

**4. Emergency relationship**
The police should respond to accidents, natural disasters and violent crimes with immediate action.Unexpectedly unexpectedly creates a high level of stress and anxiety. Officials often put life at dangerous situations without sufficient resources.

**5. More work in a very short time**
Officers often need to handle many issues or responsibilities at the same time. The report is burnout with the hope of completing the patrolling within the short time limit.Continuous pressure to give results negatively affects their goodness.

**6. VIP Security on the streets that are longer in the course of hours**
During VIP security tasks, the authorities should stand for an extended period of time. Lack of movement and lack of tough weather conditions leads to physical fatigue. Long safety hours prevent the sleeping plan and increase the stress level.

**7. Lack of labor**
Many officers need to handle tasks for a large workforce. This reduces overwork, low efficiency and the response time for emergency conditions increases. Officials struggle to balance many roles and affect their results.

**8. Continuous work for women**
Female officials can withstand excessive heat during long shifts, causing dehydration and fatigue.

The physical toll money is high due to long -term contact contact when patrolling or managing

traffic. Heat stress affects concentration, decision -making and general job performance.

**9. Work in winter for women**
Female officials who work at night suffer from shift cold stress and related diseases in winter.

The health risk is increasing due to contact with excessive colds during increasing or handling external duties. Inadequate protective equipment and tough condition cause discomfort and fatigue.

**10. Traffic tax is very risky for women**
Female officials have significant risks, handle traffic violations and accident scenes. They are more vulnerable to traffic accidents, public harassment and security problems Traffic duty includes pollution, extreme weather and exposure to aggressive drivers.

**11. Night laps for women**
Female officials who work at night face security problems, especially in isolated areas.

Irregular sleep patterns lead to insomnia, chronic fatigue and health problems.

Balancing individually and professional run

$$\mu_{Mod}(x)=\begin{cases}\dfrac{5-x}{5-1}, & if\ \ x\in[1,5]\\ 0 & else\end{cases} \qquad \nu_{Mod}(x)=\begin{cases}\dfrac{(x-1)}{6-1} & if\ \ x\in[1,6]\\ 1 & else\end{cases}$$

$$\mu_{strong}(x)=\begin{cases}\dfrac{3-x}{7-1}, & if\ \ x\in[3,7]\\ 0 & else\end{cases} \qquad \nu_{strong}(x)=\begin{cases}\dfrac{(x-3)}{8-3} & if\ \ x\in[3,8]\\ 1 & else\end{cases}$$

$$\mu_{v.strong}(x)=\begin{cases}\dfrac{5-x}{9-5}, & if\ \ x\in[5,9]\\ 0 & else\end{cases} \qquad \nu_{v.strong}(x)=\begin{cases}\dfrac{(x-5)}{10-5} & if\ \ x\in[5,10]\\ 1 & else\end{cases}$$

$$\mu_{extreme}(x)=\begin{cases}\dfrac{5-x}{5-1}, & if\ \ x\in[7,11]\\ 0 & else\end{cases} \qquad \nu_{extreme}(x)=\begin{cases}\dfrac{(x-1)}{12-1} & if\ \ x\in[1,12]\\ 1 & else\end{cases}$$

$$\mu_{equal}(x)=\begin{cases}\dfrac{1-x}{3-1}, & if\ \ x\in[1,3]\\ 0 & else\end{cases} \qquad \nu_{equal}(x)=\begin{cases}\dfrac{(x-1)}{4-1} & if\ \ x\in[1,4]\\ 1 & else\end{cases} \tag{9}$$

Using the above formula

$$CM = \begin{bmatrix}
0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.4 & 0.6 & 0.4 & 0.5 & 0.2 & 0.7 & 0.2 & 0.8 & 0.5 & 0.5 & 0.4 & 0.5 \\
0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.3 & 0.7 & 0.1 & 0.8 & 0.5 & 0.5 & 0.5 & 0.5 \\
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0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 \\
0.6 & 0.4 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.3 & 0.7 & 0.4 & 0.5 & 0.5 & 0.5 \\
0.5 & 0.4 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.4 & 0.4 & 0.6 & 0.5 & 0.5 & 0.2 & 0.8 \\
0.7 & 0.2 & 0.7 & 0.3 & 0.7 & 0.3 & 0.6 & 0.3 & 0.5 & 0.4 & 0.7 & 0.3 & 0.5 & 0.4 & 0.5 & 0.5 & 0.4 & 0.6 & 0.4 & 0.6 & 0.4 & 0.5 \\
0.8 & 0.2 & 0.8 & 0.1 & 0.8 & 0.2 & 0.7 & 0.3 & 0.5 & 0.4 & 0.7 & 0.3 & 0.6 & 0.4 & 0.6 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 \\
0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.6 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 \\
0.5 & 0.4 & 0.5 & 0.5 & 0.6 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.8 & 0.2 & 0.5 & 0.4 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5
\end{bmatrix}$$

By equation [5],[6] generate the intuitionistic preference relation Matrix to check consistent

**Table-1-** Intuitionistic Comparison Matrix

| | H1 | | H2 | | H3 | | H4 | | H5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| CM1 | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ |
| H1 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.44949 | 0.44949 | 0.44949 | 0.307692 | 0.5 |
| H2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.5 | 0.44949 | 0.35247 | 0.5 |
| H3 | 0.449 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 |
| H4 | 0.449 | 0.44949 | 0.44949 | 0.5 | 0.5 | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 |
| H5 | 0.5 | 0.307692 | 0.5 | 0.35247 | 0.5 | 0.5 | 0.5 | 0.4 | 0.5 | 0.5 |
| H6 | 0.5 | 0.307692 | 0.44949 | 0.35247 | 0.5 | 0.4 | 0.44949 | 0.5 | 0.5 | 0.5 |
| H7 | 0.634 | 0.385953 | 0.44949 | 0.44949 | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 | 0.5 |
| H8 | 0.814 | 0.07675 | 0.608696 | 0.16 | 0.555006 | 0.225381 | 0.44949 | 0.307692 | 0.5 | 0.5 |
| H9 | 0.552 | 0.005605 | 0.897231 | 0.048441 | 0.777778 | 0.134591 | 0.777778 | 0.134591 | 0.696168 | 0.262726 |
| H10 | 0.821 | 0.057032 | 0.707194 | 0.170632 | 0.740781 | 0.16 | 0.740781 | 0.16 | 0.55051 | 0.307692 |
| H11 | 0.853 | 0.025521 | 0.859355 | 0.04625 | 0.823529 | 0.104458 | 0.823529 | 0.104458 | 0.666667 | 0.213939 |

| H6 | | H7 | | H8 | | H9 | | H10 | | H11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ | $\mu$ | $\nu$ |
| 0.307692 | 0.5 | 0.385953 | 0.633975 | 0.07675 | 0.813616 | 0.005605 | 0.552301 | 0.057032 | 0.307692 | 0.025521 | 0.852867 |
| 0.35247 | 0.4494897 | 0.44949 | 0.44949 | 0.16 | 0.608696 | 0.048441 | 0.897231 | 0.170632 | 0.35247 | 0.04625 | 0.859355 |
| 0.4 | 0.5 | 0.4 | 0.5 | 0.225381 | 0.555006 | 0.134591 | 0.777778 | 0.16 | 0.4 | 0.104458 | 0.823529 |
| 0.44949 | 0.5 | 0.4 | 0.5 | 0.307692 | 0.44949 | 0.134591 | 0.777778 | 0.16 | 0.44949 | 0.104458 | 0.823529 |
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.262726 | 0.696168 | 0.307692 | 0.5 | 0.213939 | 0.666667 |
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.44949 | 0.35247 | 0.6 | 0.303832 | 0.5 | 0.151229 | 0.753394 |
| 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.44949 | 0.5 | 0.44949 | 0.5 | 0.4 | 0.5 |
| 0.44949 | 0.5 | 0.5 | 0.4 | 0.5 | 0.5 | 0.4 | 0.6 | 0.44949 | 0.44949 | 0.4 | 0.6 |
| 0.6 | 0.3524704 | 0.5 | 0.44949 | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 |
| 0.651669 | 0.3038324 | 0.55051 | 0.44949 | 0.55051 | 0.44949 | 0.5 | 0.5 | 0.5 | 0.651669 | 0.5 | 0.5 |
| 0.753394 | 0.1512291 | 0.5 | 0.4 | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 | 0.753394 | 0.5 | 0.5 |

The two matrices mentioned above, along with equations [7] and [8], are used to calculate the distance between intuitionistic fuzzy values. d(M,M) equals 0.1119115. which falls below the cutoff value of 0.15. As a result, the aforementioned matrix is accurate.

**Table-2 –** Weight of Membership and non-Membership

| Attributes | Weight | $\mu$ | $\nu$ |
|---|---|---|---|
| Investigation | W(H1) | 0.06015609 | 0.873 |
| Maintaining law and order | W(H2) | 0.06425087 | 0.867 |
| Court duty | W(H3) | 0.06173075 | 0.871 |
| Emergency situations. | W(H4) | 0.06037432 | 0.865 |
| More work in too less time was extremely demanding. | W(H5) | 0.07134361 | 0.855 |
| Long time standing during VIP security hours in road. | W(H6) | 0.06678494 | 0.852 |
| Lack of man power. | W(H7) | 0.07140146 | 0.854 |
| Continuous working in summer season for women | W(H8) | 0.07271441 | 0.836 |
| Continuous working in winter season for women. | w(H9) | 0.08648703 | 0.813 |
| Traffic duty is very risk for women. | w(H10) | 0.16943978 | 0.82 |
| Night shift for women | W(H11) | 0.17567961 | 0.805 |

**Table-3-** Ranking of the Attributes

| S.No | Attributes | $\rho(\alpha)$ | Ranking |
|---|---|---|---|
| 1 | Lack of man power. | 0.93628364 | 1 |
| 2 | Long time standing during VIP security hours in road. | 0.93340476 | 2 |
| 3 | Emergency situations. | 0.93546831 | 3 |
| 4 | Continuous working in summer season for women | 0.93236387 | 4 |
| 5 | Traffic duty is very risk for women. | 0.92749891 | 5 |
| 6 | Investigation | 0.92618657 | 6 |
| 7 | Maintaining law and order | 0.92707662 | 7 |
| 8 | Continuous working in winter season for women. | 0.9177931 | 8 |
| 9 | Court duty | 0.90648704 | 9 |
| 10 | Night shift for women | 0.90976401 | 10 |
| 11 | More work in too less time was extremely demanding. | 0.9023394 | 11 |

The weights of all qualities are then determined using the equation [9] in the following step. Ranking the attribute based on the derived values is done using the weight (()) from equation [1]. The results are shown in Table-3.

**RESULT**

Based on the input given by the expert of the police stress factors hierarchy was formed and in the Level-1 three attributes are framed in level-1. In the level-3 eleven stress factors are fixed in Heavy work load. Based on the result from the Table-3 the following attributes are identified such as Lack of man power, Long time standing during VIP security hours in road, Emergency situations, Continuous working in summer season for women, Traffic duty is very risk for women, Investigation, Maintaining law and order, Continuous working in winter season for women, Court duty, Night shift for women and More work in too less time was extremely demanding.

**DISCUSSION**

In the given graph depicts that IFAHP with Delphi values are higher than those of the standard AHP parameters in the line graph. This means that the model's resulting stress factors are skewed when expert input is provided. As previously stated, I evaluated the model using AHP frameworks, however, capturing nuances that AHP tends to forget is something that added expert validation appears to do. Compared to FAHP, the difference appears to be considerably smaller. Weight trends are very similar for both models because they rely on fuzzy logic. The more nuanced details seem to suggest the Delphi process has adjusted the fuzzy evaluations by using the knowledge of seasoned practitioners, which improves the contextually relevant priorities to be slightly more accurate. IFAHP With Delphi Vs IFAHP The analysis against IFAHP, the compared method, yielded results that were nearly equal, showing that the base fuzzy model is strong. IFAHP case studies. The addition of the Delphi technique does not change the outcomes significantly; instead, it softens the results to better represent expert input and increases the credibility of the model and practical application of the results.

| Attributes | IFAHP With Delphi | AHP | FAHP | IFAHP |
|---|---|---|---|---|
| H1 | 0.93628364 | 0.921 | 0.92917 | 0.929169 |
| H2 | 0.93340476 | 0.86 | 0.93331 | 0.932383 |
| H3 | 0.93546831 | 0.76 | 0.97625 | 0.931283 |
| H4 | 0.93236387 | 0.83 | 0.91043 | 0.91565 |
| H5 | 0.92749891 | 0.9 | 0.85121 | 0.911122 |
| H6 | 0.92618657 | 0.76 | 0.93271 | 0.936354 |
| H7 | 0.92707662 | 0.79 | 0.88505 | 0.921354 |
| H8 | 0.9177931 | 0.75 | 0.82102 | 0.915313 |
| H9 | 0.90648704 | 0.76 | 0.91043 | 0.931283 |
| H10 | 0.90976401 | 0.83 | 0.91043 | 0.912122 |
| H11 | 0.9023394 | 0.75 | 0.88505 | 0.934283 |

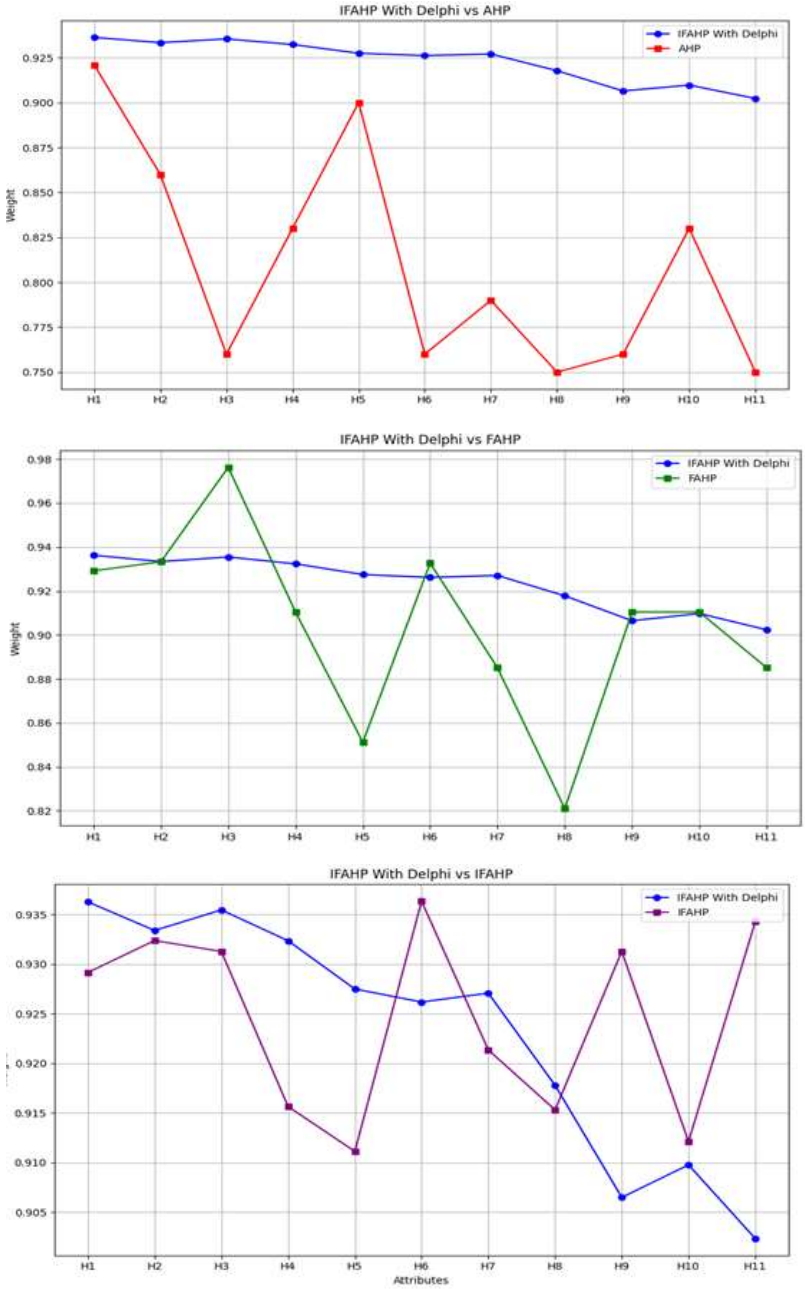


**Figure-3** Comparative graph

It will be observe that from the Table-4 and Figure-1 of AHP with fuzzy Delphi (proposed) and AHP method in the stress factors of in Heavy work in the level-3, the curve of proposed system deviation is very less compare to the AHP.

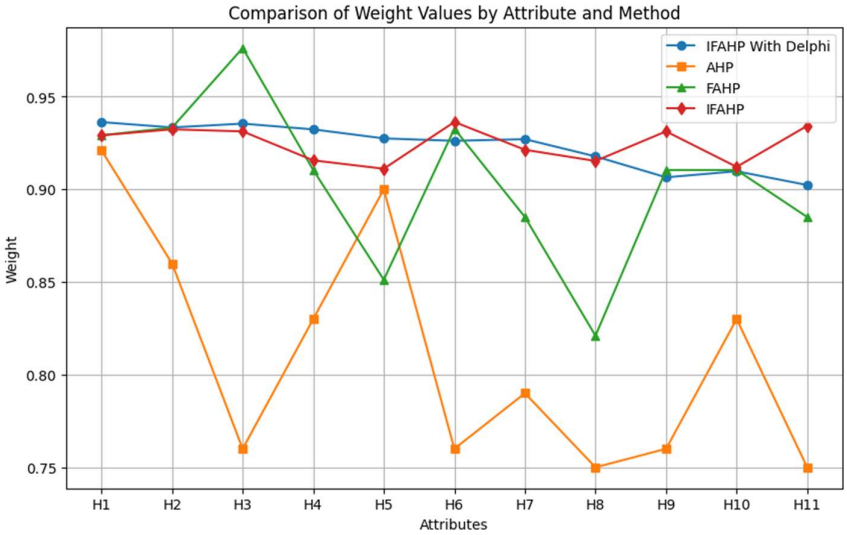


**Figure-3** Comparison of weight values by Attribute and Method

- Based on the Observation from the Table-4 and Figure-1 of FAHP with fuzzy Delphi (proposed) and AHP method in the stress factors of in Heavy work in the level-3, the curve of proposed system deviation is very less compare to the FAHP.

**Advantages of the Proposed Model (IFAHP)**

Incorporated Expert Knowledge: The proposed model decreases the unpredictability and subjectivity that accompanies complex decision-making processes by incorporating the epost-Delphi technique and expert feedback. After the fuzzy evaluations are rendered, experts validate them and aid in the adjustment of the weight assignments that are allocated to the stress factor, which makes the evaluation process more accurate.

Adaptability: The model integrates qualitative data in a way that allows for clarity in vague differences between stress factors that could be missed by a quantitative only approach like AHP. This guarantees that the weight that is allocated to the most important factors is not underestimated.

Holistic Approach To Problem Solving: The decision model is able to use the rigid fuzzy AHP structure as a backbone, but uses human intelligence for refinement. This combination of quantitative and qualitative approaches provide a greater depth of analysis, which is very important in areas that require both precise and firsthand knowledge, such as police stress management.

Innovation in Reality: This model seems to comply with real-life conditions because of the slight adjustments it makes against the traditional fuzzy methods. Stress factor and resource allocation is integrated to aid all decision makers, knowing it is accurate, improves the overall system.

## CONCLUSION

A comprehensive approach to identify and prioritize stress factors in Tamil Nadu Police Church by integrating the Intuitiionistic fuzzy analytical hierarchy process (IFAHP) with Delphi technology. This innovative combination models allows the model to effectively handle the underlying uncertainty in expert decisions, while ensuring that qualitative insights from experienced police personnel and domain experts are included. Important findings indicate that the hierarchical structure successfully classifies stress factors - insufficient supervisory support ranging from heavy workload to lack of resources - and gives a clear priority of the most important issues. By assigning each stress factor refined weight values, the model not only determines the relative importance of these factors, but also highlights the areas where goal intervention officers can have the most impact on the improvement in welfare and general performance.

**Work shows many benefits:**

Sales -promoting reliability: Integration of Delphi ensures that Fuzzy AHP output experts are valid of consensus, reduce the content and increase the strength of the model.

Fine assessment: The use of allows both subscriptions and degrees to capture both degrees, reflecting the complex nature of stress factors in a high-day environment as a law enforcement.

Practical projection: The developed structure provides action -rich insights that can guide political decisions, resource allocation and stress management interventions in the police force. While the study makes a significant contribution by combining quantitative modeling with qualitative expert input, it also opens for further research. Can focus on validation of future work

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