



Contents lists available at ScienceDirect

## Safety and Health at Work

journal homepage: [www.e-shaw.net](http://www.e-shaw.net)

Original article

## Modelling the factors affecting Quality of Life among Indian police officers: a novel ISM and DEMATEL approach

Vineet Jain <sup>1,\*</sup>, Hanif Qureshi <sup>2</sup><sup>1</sup> Department of Mechanical Engineering, Mewat Engineering College, Nuh, Haryana, India<sup>2</sup> Commissioner of Police Panchkula, Haryana, India

## ARTICLE INFO

## Article history:

Received 3 June 2021

Received in revised form

16 July 2022

Accepted 22 July 2022

Available online 17 August 2022

## Keywords:

DEMATEL

ISM

MICMAC

Modeling

QOL of Indian police

## ABSTRACT

**Background:** This study examines quality of life (QOL) of a sample of police officers in India. The concept of QOL includes well-being, social obligations, relationships of a person, and his association with environment. The study examines the factors on which QOL of police officers depend and their relationships with each other. The issues linked with QOL are important because they directly affect the individual's ability to maintain a healthy lifestyle and affect organizational performance in the long run. This study explores relevant factors that have an impact on the QOL of the employees of police department in India. **Method:** In this paper, literatures review, ISM, MICMAC, and DEMATEL methodology have established eleven factors that impact the QOL of police officers in India. Mutual relations between factors have been established using the ISM approach to develop a model to represent these relationships. DEMATEL methodologies were used to analyze these factors.

**Results:** Results indicate that “fair compensation, work overload, workplace safety, and job stress” are the top-level factors that affect QOL of police officers.

**Conclusion:** The identification of factors and their mutual relationships that affect QOL are important for police officers and have to be dealt with according to their order of importance. The research model developed in this study shows how the factors of police officers' QOL are interrelated and presents the interrelationships among these factors. A comprehensive model depicting the relationships among these factors has been established, so that the QOL of police officers can be improved.

© 2022 Occupational Safety and Health Research Institute, Published by Elsevier Korea LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The police are responsible for maintaining public order, prevention, and investigation of crimes and are the principal law enforcement agency. As elsewhere, working in the Indian police department is regarded as a matter of pride [1]. Due to a variety of reasons including their exposure to conflict, abuse, and trauma, including the risk of injury or death, police work appears to be stressful and hazardous [2]. There are two major types of work pressures for police officers: external factors such as injury risk, and internal factors such as employment disputes, and strained relations between seniors and subordinates [3]. The police face both real and imaginary threats that may trigger tension and suffering inherent in the profession [4]. Workplace climate has a significant effect on the workers as well as their families [5]. Employees'

inability to reconcile their personal obligations and job demands often amplifies organizational tensions leading to health problems [6]. Work-related stress can lead to depression, which has a strong correlation with work disability and low quality of life (QOL), especially in police work [2]. To a large extent, employee engagement and job satisfaction rely on QOL [7].

QOL is a multidimensional concept that relates to a person's well-being. The discussion and use of QOL as a measurable outcome in health has increased in recent times though not so much in police organizations. Walton [8] emphasized the importance of QOL as a strategy for economic growth and productivity. Howard (1993) defined QOL as both a goal and a continual process [9]. Police were usually seen as a male-dominated organization but as more women enter the work force, there is an increased awareness and concern to consider the working time, salary, childcare, and other issues to

Vineet Jain: <https://orcid.org/0000-0002-4662-3081>; Hanif Qureshi: <https://orcid.org/0000-0002-7922-5645>

\* Corresponding author. Mewat Engineering College, Nuh, Haryana, 122107, India.

E-mail addresses: [vdj2004@gmail.com](mailto:vdj2004@gmail.com) (V. Jain), [hanifq@gmail.com](mailto:hanifq@gmail.com) (H. Qureshi).

fulfill their needs [10]. Akdere [11] stated that based on survey of working adults conducted by New York Times (1998), 83% of working mothers and 72% of working of fathers reported that they experienced conflict between job demands and the desire to meet their families.

QOL is generally understood as the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events [12]. It may be the experience an individual has of his or her own life and/or the living conditions in which individuals find themselves. This is because QOL may mean different things to different individuals. Therefore, we have several definitions of QOL. For instance, the World Health Organization (WHO) defines QOL as “an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” [13]. Standard indicators of the QOL include wealth, employment, the environment, physical and mental health, education, recreation and leisure time, social belonging, religious beliefs, safety, security, and freedom. According to Encyclopedia Britannica, it is the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events [14].

Police personnel usually have higher levels of stress and anxiety than other professions [15]. Partly due to the physical hazards in their job being considerable, police have been recognized as one of the most stressful occupations in the world [16]. The detection of offenders, the prevention and investigation of crimes, and the maintenance of public order are all responsibilities of police personnel. At the same time, they are faceless and nameless persons, and the majority of people regard them as a distinct group from the rest of society [17]. Police officers are important for social order and cohesion, and it would be worthwhile to examine factors affecting QOL of police officers and consider what steps could be taken to improve their QOL. Police officers spend a large part of their lives fulfilling their job obligations and if they are not comfortable with the work environment, they cannot perform their job satisfactorily. Some studies have been performed on QOL of police officers in Western countries like USA and UK [17,18]. Studies on QOL are, however, not common in low and middle-income countries like India.

Therefore, the objectives of present study are as follows:

1. To identify factors affecting QOL of police officers in India and construct the mutual relationships among these factors using ISM methodology.
2. To analyze the identified factors through a cause-and-effect diagram by using the DEMATEL approach.

## 2. Material and methods

### 2.1. Literature review

QOL research studies the relationship between life satisfaction and QOL [19]. It is well recognized that employees with higher levels of well-being are more committed and optimistic than those with lower levels of well-being [20]. Workplace stressors have detrimental effects on the QOL of Indian police officers at work.

To retrieve relevant documents in indexed databases, the search contents “quality of life of police officers” were used. The bibliographic search was carried out in 2020 during the month of September. It included all of the retrieved studies. Table 1 summarizes the studies.

### 2.2. Identification of factors for the QOL in the India police officers

Literature review thoroughly and extracted the relevant factors that affect QOL of Indian police officers.

The following final eleven QOL factors were elicited from the literature review.

1. *Job satisfaction*: Alexopoulos, Palatsidi [17] reported that there is a significant relationship between perceived stress, job satisfaction, and QOL of police officers. The uncondusive working climate has a negative correlation with job satisfaction [32,33].
2. *Workplace safety*: Adequate hours should be defined by a structured daily working period beyond which premium wage is required. Healthy working conditions that minimize the risk of disease and illness are important. Age limitations may be imposed when work is hazardous to the health of people below (or above) a certain age [8].
3. *Fair compensation*: One of the most common motivations to work is to make a living. Fair compensation as a dimension of QOL has therefore been suggested. Earning from job should be adequate in order to live with a socially specified requirement [8,34].
4. *Opportunities for personal growth and development*: In their study, Easton and Van Laar [35] have proposed that opportunities for personal growth and development are an important component of QOL. They include workplace social needs fulfillment and employee rights security.
5. *Social relevance of work-life*: Occupational stress significantly affects relationships in all areas of life. It may have a significant impact on the way that an individual lives his or her daily life and interacts with others, and this may be especially

**Table 1**  
QOL studies related to police officers

Sr. No.	Authors with year	Nation of police officers	Instrument
1	Kale and Gedik [21]	Turkish riot police officers	World Health Organization QOL (WHOQOL-BREF)
2	Costa, Vieira [22]	Porto Alegre civil police officers	WHOQOL- BREF
3	Wu, Liu [23]	China criminal police officers	EuroQol five-dimension three-level (EQ-5D-3L) scale
4	Alexopoulos, Palatsidi [17]	Athens, Greece police officers	General Health Questionnaire-28 (GHQ-28), (WHOQOL-BREF)
5	da Silva, Hernandez [24]	Santa Catarina, Brazil military police officers	International Physical Activity Questionnaire, Short Form Health Survey
6	Andrade, Sousa [25]	Río de Janeiro, Brazil civil police officers	WHOQOL-BREF
7	Kutlu, Civi [26]	Konya police officers	Beck depression Inventory (BDI), WHOQoL-BREF
8	Lipp [27]	São Paulo, Brazilian police officers	Stress Symptoms Inventory (LSSI), QLI
9	Kutlu, Çivi [28]	Konya municipal police officers	BDI, WHOQoL-BREF
10	line Slottje, Twisk [29]	Amsterdam, Holland police officers	SF-36
11	Chen, Chou [2]	Kaohsiung, Taiwan police Officers	SF-12 and the Disaster-Related Psychological Screening Test
12	Golub, Johnson [30]	New York City, United States of America police officers	Arrestee Drug Abuse Monitoring (ADAM) Policing survey
13	Katz, Webb [31]	Chandler, Arizona police officers	Calls for service (CFS)

challenging when his relationships with family and friend circle are involved [36].

6. *Work overload*: The heavy workload in the organization raises occupational exhaustion for workers and creates job overload problems. High work stress predisposes workers to tiredness, and heavy workloads cause stress and dissatisfaction [37].
7. *Physical health*: Physical health was agreed to have a positive impact on health-related QOL [17].
8. *Job stress*: Cannon [38] was one of the first persons to unravel the mystery of stress [1]. Work overload was extensively studied with many job outcomes, together with work stress [15,37]. Occupational stress results in physical conditions due to changes in the internal body structure while trying to cope with stress.
9. *Daily activities*: Daily activities have a direct relationship with QOL. Heavy workload and occupational stress lead to reduced mobility leading to hampered daily activities [39].
10. *Sleep patterns*: Employees generally suffer from poor sleep habits and feel difficulty in having a sound sleep. Some sleep excessively while some of them are unable to get adequate sleep [40].
11. *Mental health*: People perceive stress in occupation as very challenging, and later on, may develop psychiatric problems like the feelings of anxiety and depression [36].

After identification of factors through literature, the Delphi method was used to get the opinion of experts.

### 2.3. Delphi method

The Delphi method was developed by RAND in the 1950s to forecast the effect of technology on warfare. The RAND Corporation is a nonprofit that helps improve policy and decision-making through research and analysis. In the present day, the Delphi method has been applied to healthcare, education, management, and environmental science. It is essentially a technique to arrive at a decision based on the results of multiple rounds of questionnaires sent to a panel of experts. In the current study, 12 experts were selected from police services, academia, and health agencies. For Delphi method, 10–30 experts are generally considered enough [41]. First, we share the questionnaire to the experts. There were 20 factors in the questionnaire as given in supplementary file. Questionnaire was validated in term of Content Validity Index. The value of Delphi method lies in its value of the expertise which the diverse group of experts have. The factors affecting QOL were already identified from literature review. The method aggregates opinions from a diverse set of experts, without the need to bring everyone together for a physical meeting. It is agreed that a live discussion can produce better results. In the present study, experts from police services, academia, and health agencies were involved in the Delphi method. Since the responses of the experts are anonymous, individual participants don't have to worry about repercussions for their opinions. Consensus can be reached after response is aggregated over several rounds, making the method very effective.

In the current study, the Delphi rounds identified 11 factors, nine factors were deleted, and two factors were modified.

The final factors identified by the experts are as follows:

1. Jobs satisfaction
2. Workplace safety
3. Fair compensation
4. Opportunities for personal growth and development
5. Social relevance of work life
6. Work overload
7. Physical health

8. Job stress
9. Daily activities
10. Sleep patterns
11. Mental health

Nine factors deleted and two factor names modified were as follows:

Deleted:

1. Welfare services and facilities in organization
2. Organizational environment
3. Fair and impartial compensation policy
4. Dietary patterns
5. Psychological health
6. Physical illness
7. Depression
8. Exposure to disasters
9. Systemic disorders leading to discomfort and pain

Factors modified:

1. Safe and healthy working conditions becomes workplace safety
2. Adequate and fair compensation becomes fair compensation

In this way, after a few rounds, a consensus was reached, and 11 factors were unanimously agreed to be most affecting QOL of police officers in India and shown in Table 2.

### 2.4. Methodology

The use of ISM and DEMATEL has seen an increase in many countries of the world including India. It has been used in India in a variety of areas. For instance, this technique has been used in the analysis of government measures in combatting COVID-19 [42], IoT barriers [43], sales of electric vehicle in India [44], Indian retailing apparel firms [45], Indian state public hospitals [46], waste recycling barriers in India [47], and implementation of e-waste management practices in India [48].

#### 2.4.1. ISM methodology

Interpretive structural modeling (ISM) is a computer-based technique for identifying relationships among specific items, which define a problem or an issue. This approach is now being used increasingly to represent the interrelationships among various elements related to an issue. ISM approach starts with an identification of variables, which are relevant to the problem or issue, QOL in our case. Then a contextually relevant subordinate relation is chosen. Having decided the contextual relation a

**Table 2**  
Extract of Delphi questionnaire

S. No.	Delphi final round
1	Jobs satisfaction
2	Workplace safety
3	Fair compensation
4	Opportunities for personal growth and development
5	Social relevance of work life
6	Work overload
7	Physical health
8	Job stress
9	Daily activities
10	Sleep patterns
11	Mental health

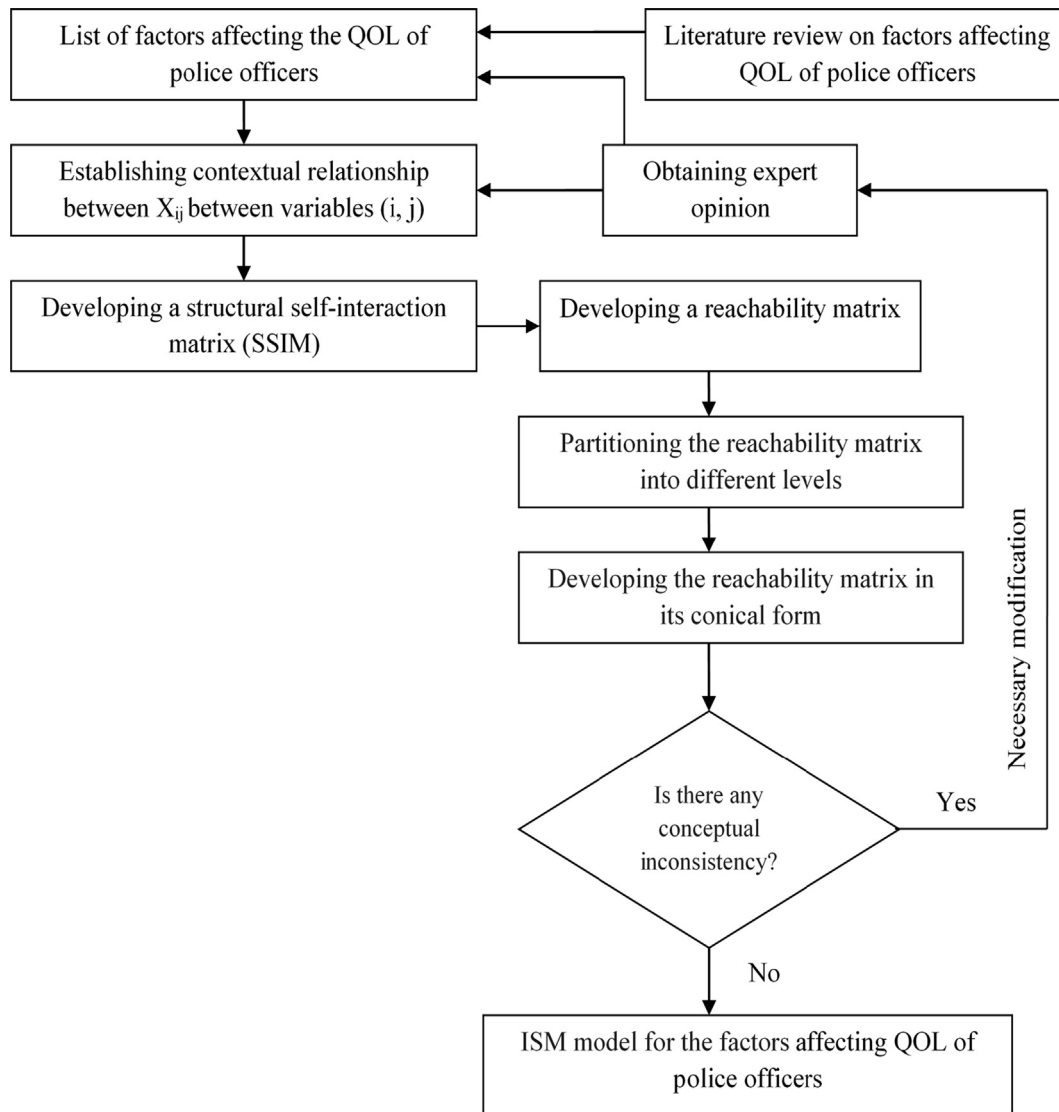


Fig. 1. Flow diagram of ISM technique.

structural self-interaction matrix (SSIM) is developed based on pairwise comparison of variables. In the present study, we have identified the variables through the Delphi method. After this, SSIM is converted into a reachability matrix (RM), and its transitivity is checked. After the process of transitivity embedding, a matrix model is obtained. Then, the partitioning of the elements and an extraction of the structural model called ISM is derived.

ISM technique has been extensively used in fields such as classroom communication barriers [49], barriers in controlling TB [50], factors affecting global economy [51], QOL in diabetics [52], lean management [53], and selection of reverse logistics provider [54]. An ISM-based analysis has been used to conduct barrier analysis in implementing green supply chain management [55]. The steps of ISM approach are depicted in the flow diagram given below (Fig. 1) [56].

#### 2.4.2. The DEMATEL methodology

Decision-making Trial and Evaluation Laboratory (DEMATEL) is an effective method based on graph theory for the identification of cause–effect chain components of a complex system. It evaluates interdependent relationships among factors and then helps in finding the critical ones. There are several kinds of DEMATEL

including classical DEMATEL, fuzzy DEMATEL, grey DEMATEL, and other DEMATEL. This method has been extended for better decision-making under different environments especially those with imprecise and uncertain information. Therefore, the police QOL question is suitable for the employment of DEMATEL. DEMATEL technique was first developed by the Geneva Research Centre of the Battelle Memorial Institute to visualize the structure of complicated causal relationships through matrixes or digraphs.

The end-product of the DEMATEL process is a visual representation, also called the “impact–relations map” by which respondents organize their own actions in the world. DEMATEL method is use widely ranging from analyzing problematic decision-making to industrial planning. The most important property of the DEMATEL method used in the multicriteria decision-making (MCDM) field is to construct interrelations between criteria. To obtain a suitable impact–relations map, a suitable threshold value is required. This value helps to obtain adequate information for further analysis and decision-making. This technique has been used in performance evaluation of Indian Railway zones [57]. Factors affecting the performance of small and medium enterprises have been assessed using DEMATEL [58]. Different steps of the DEMATEL methodology are described below (Fig. 2) [59,60].

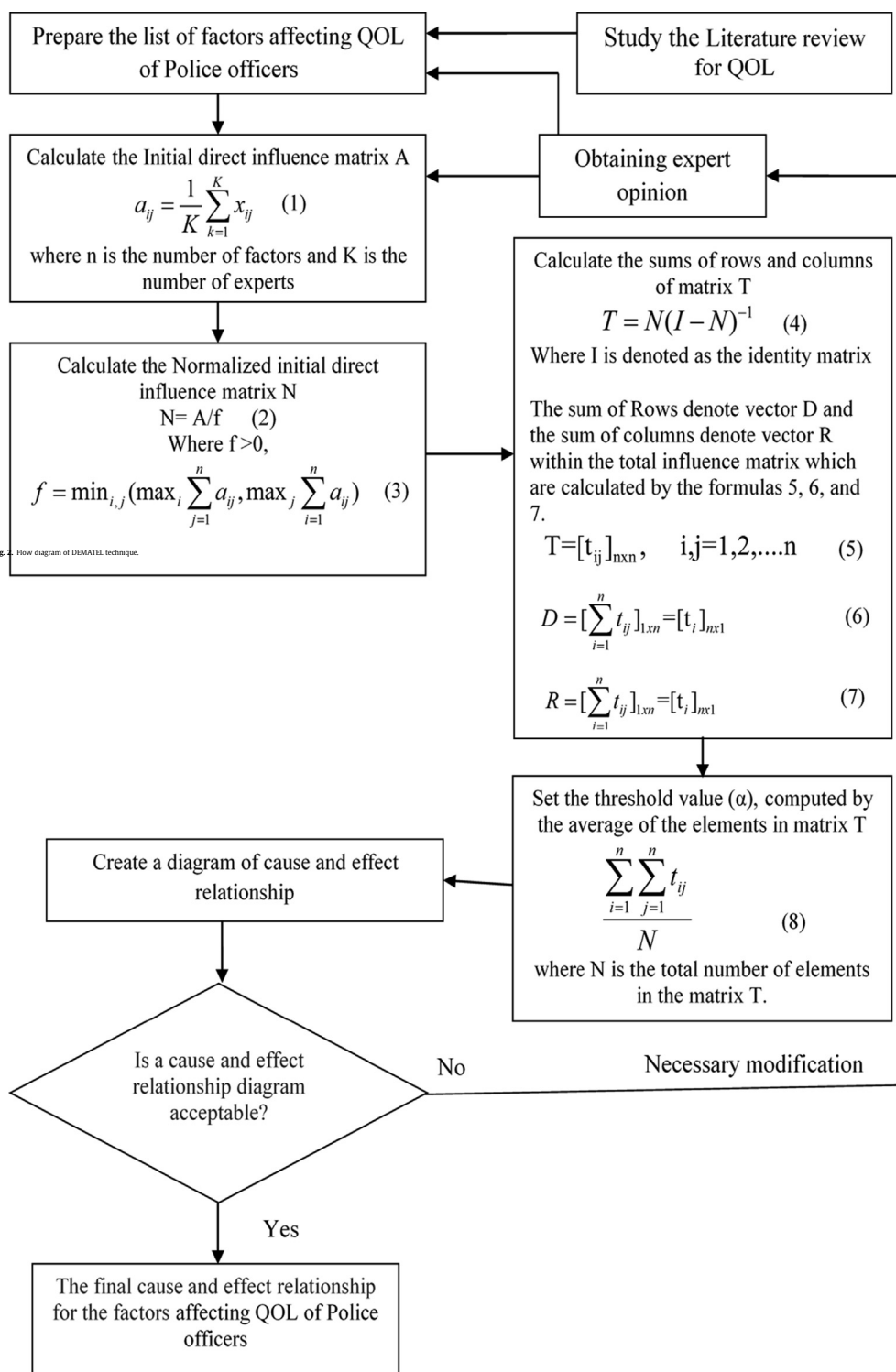


Fig. 2. Flow diagram of DEMATEL technique.

### 3. Results

#### 3.1. ISM analysis

The present work is aimed to identify the factors affecting QOL in police officers. ISM methodology was used to make a model of factors influencing their QOL. Warfield [61] first

proposed interpretive structural modeling (ISM) method to analyze complex socioeconomic systems. ISM is a technique that assists individuals to show domain knowledge into a model of interrelationships to enhance the understanding of its intricacy. With the help of experts from police officers, academic sector, and healthcare sector the mutual relationships among them were determined.



**Table 3**  
SSIM\*

Factors	Workplace safety	Fair compensation	Opportunities for personal growth and development	Social relevance of work-life	Work overload	Physical health	Job stress	Daily activities	Sleep patterns	Mental health
Job satisfaction	A	A	A	A	A	A	A	A	X	O
Workplace safety		O	O	O	O	V	V	O	V	V
Fair compensation			V	V	X	O	V	O	O	O
Opportunities for personal growth and development				X	O	O	O	O	O	O
Social relevance of work-life					A	A	A	O	O	O
Work overload						V	V	V	V	V
Physical health							A	V	V	A
Job stress								V	V	V
Daily activities									V	V
Sleep patterns										A

\* Contextual relationships among the QOL factors based on four symbols V, A, X, and O.

Following six steps were followed to model the factors affecting QOL of police officers:

1 Contextual relationship between elements

Identification of different elements (or factors), which are related to problems, and enlisted by a survey or group problem-solving technique: After this, a contextual relationship is established among elements with respect to whom the pairs of factors would be examined. From review of literature and expert's judgment, 11 factors are explored and investigated. A circumstantial precise relationship specifying that if one factor influences other, a specific contextual relationship is derived. A total of 12 experts from the police officers, academia, and health organizations were consulted, and the contextual relationships among all the factors were established [62].

2 Development of SSIM

The "structural self-interactive matrix" (SSIM) indicates the pair-wise relationship among elements of the system. This matrix uses four symbols to indicate the direction of connection between the two QOL factors A and B [63].

- I. V: factor i influences or reaches to factor j
- II. A: if factor j reaches to factor i
- III. X: both factors i and j reach to each other
- IV. O: there is no relationship between factors i and j

Depending upon the contextual relationships among the factors, SSIM is derived for eleven factors and shown in Table 3.

The use of symbols in SSIM has been explained in the following statements:

- Cell (2, 7) is assigned Symbol V because factor 2 influences or reaches to factor 7.
- Cell (1, 9) is assigned Symbol A because factor 1 influences the factor 9.
- Cell (4, 5) is assigned Symbol X because factor 4 and 5 influence each other.
- Cell (5, 9) is assigned Symbol O because factor 5 and 9 are not related.

3 Development of the "Reachability Matrix (RM)"

RM is derived from SSIM. RM specifies the relationships among factors in the binary form as per the methodology [64]. Binary digits of 0 and 1 are now substituted to replace the symbols V, A, X,

**Table 4**  
Symbol in SSIM

Symbol in SSIM	Binary digit in initial RM
V to the cell (i,j)	cell (i,j) entry becomes 1 and the cell (j,i) entry becomes 0
A to the cell (i,j)	cell (i,j) entry becomes 0 and the cell (j,i) entry becomes 1
X to the cell (i,j)	this cell (i,j) entry becomes 1 and the cell (j,i) entry also becomes 1
O to the cell (i,j)	cell (i,j) entry becomes 0 and the cell (j,i) entry also becomes 0

and O. The criteria used to replace "V, A, X, and O" of SSIM to develop RM is illustrated in Table 4 and reachability matrix is shown in Table 5 [65].

To build the final RM "final Reachability matrix" transitivity is incorporated, which implies that if there is a relationship between the first and second factors, and between the second and third factors, then there must be a link between the first and third factors. Table 6 displays the final RM, with transitivity denoted as 1\*.

4 Partitioning the "RM"

For this step "reachability and antecedent set" of each factor is needed which is derived from the final RM [66]. These sets are completed iteratively and are used to determine the level of each factor. The reachability set demonstrates which factors cause other factors, whereas the antecedent set demonstrates which factors are impacted by other factors. These data are derived from the final reachability matrix (Table 6), with 1s in the rows indicating reachability sets and 1s in the columns signifying antecedent sets.

For example, the reachability set for "factors 1" is 1 and 10, while the antecedent set is 1,2,3,4,5,6,7,8,9,10, and 11. The intersection is the common set of factors in both the reachability and antecedent sets. When a reachability set is repeated in the intersection set, this factor is chosen as the current top position in the ISM hierarchy model (e.g. at the start level I). That factor is then dropped from the current iteration, and the next iteration begins. Level of partitioning is shown in Table 7.

5 Development of "conical matrix"

Conical matrix is formed by grouping the columns and rows that have similar leveling. Table 8 shows the results. In order to create a factor drive power, add the number of rows and dependence power by the adding the number of columns.

**Table 5**  
RM (reachability matrix)

Factors	Jobs satisfaction	Workplace safety	Fair compensation	Opportunities for personal growth and development	Social relevance of work-life	Work overload	Physical health	Job stress	Daily activities	Sleep patterns	Mental health
Job satisfaction	1	0	0	0	0	0	0	0	0	1	0
Workplace safety	1	1	0	0	0	0	1	1	0	1	1
Fair compensation	1	0	1	1	1	1	0	1	0	0	0
Opportunities for personal growth and development	1	0	0	1	1	0	0	0	0	0	0
Social relevance of work-life	1	0	0	1	1	0	0	0	0	0	0
Work overload	1	0	1	0	1	1	1	1	1	1	1
Physical health	1	0	0	0	1	0	1	0	1	1	0
Job stress	1	0	0	0	1	0	1	1	1	1	1
Daily activities	1	0	0	0	0	0	0	0	1	1	1
Sleep patterns	1	0	0	0	0	0	0	0	0	1	0
Mental health	0	0	0	0	0	0	1	0	0	1	1

**Table 6**  
FRM<sup>†</sup>

Factors	Jobs satisfaction	Workplace safety	Fair compensation	Opportunities for personal growth and development	Social relevance of work-life	Work overload	Physical health	Job stress	Daily activities	Sleep patterns	Mental health
Job satisfaction	1	0	0	0	0	0	0	0	0	1	0
Workplace safety	1	1	0	0	1*	0	1	1	1*	1	1
Fair compensation	1	0	1	1	1	1	1*	1	1*	1*	1*
Opportunities for personal growth and development	1	0	0	1	1	0	0	0	0	1*	0
Social relevance of work-life	1	0	0	1	1	0	0	0	0	1*	0
Work overload	1	0	1	1*	1	1	1	1	1	1	1
Physical health	1	0	0	1*	1	0	1	0	1	1	1*
Job stress	1	0	0	1*	1	0	1	1	1	1	1
Daily activities	1	0	0	0	1*	0	1*	0	1	1	1
Sleep patterns	1	0	0	0	0	0	0	0	0	1	0
Mental health	1*	0	0	0	1*	0	1	0	1*	1	1

<sup>†</sup> Final reachability matrix based on SSIM and transitivity is incorporated in it.

**Table 7**  
Level of iterations<sup>‡</sup>

Factors	Reachability set	Antecedent set	Intersection set	Level
Job satisfaction	1,10	1,2,3,4,5,6,7,8,9,10,11	1,10	I
Sleep patterns	1,10	1,2,3,4,5,6,7,8,9,10,11	1,10	I
Opportunities for personal growth and development	4,5	3,4,5,6,7,8	4,5	II
Social relevance of work-life	4,5	2,3,4,5,6,7,8,9,11	4,5	II
Physical health	7,9,11,12	2,3,6,7,8,9,11	7,9,11	III
Daily activities	7,9,11	2,3,6,7,8,9,11	7,9,11	III
Mental health	7,9,11,12	2,3,6,7,8,9,11	7,9,11	III
Job stress	8	2,3,6,8	8	IV
Workplace safety	2	2	2	V
Fair compensation	3,6	3,6	3,6	VI
Work overload	3,6	3,6	3,6	VI

<sup>‡</sup> Level of iterations developed from FRM and ISM model developed based on this.

## 6 Development of ISM model

The hierarchical structure model is derived from the level of partition (Table 6) and is shown in Fig. 3. Interdependence between the factors “j” and “i” is shown by an arrow pointing from “i” and “j” [48]. It is eventually transformed into the ISM model from the digraph. The ISM methodology eliminates transitivity by using the transitivity rule. To illustrate, it is obvious from Table 5 that job satisfaction and sleep patterns are found at level 1. According to Fig. 3, job satisfaction and sleep patterns are likewise at the top of the ISM model. Fig. 3 depicts the full ISM model for all factors. The ISM

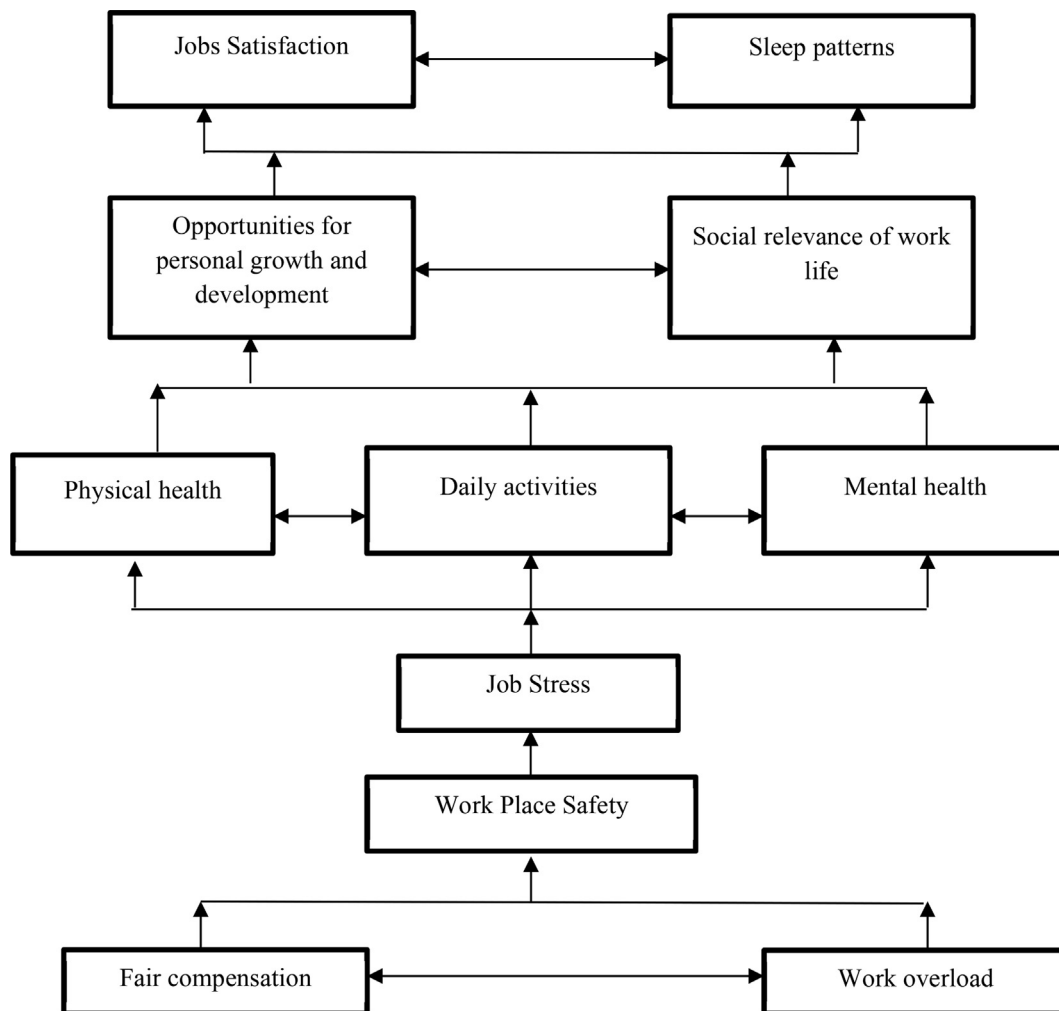
model is constructed using the level divisions in Table 6. Each QOL element is positioned according to its subsequent level, and their relationships are fixed from the bottom (level 6) to the top of the model (level 1). Fig. 3 depicts the multilevel hierarchy model created using identified relationships between significant factors affecting the QOL of Indian police officers.

The arrow depicts the multilevel hierarchy model and the relationships between significant factors affecting the QOL of Indian police officers.

**Table 8**  
Conical matrix<sup>§</sup>

Factors	Jobs satisfaction	Sleep patterns	Opportunities for personal growth and development	Social relevance of work-life	Physical health	Daily activities	Mental health	Job stress	Workplace safety	Fair compensation	Work overload	Driving power
Job satisfaction	1	1	0	0	0	0	0	0	0	0	0	2
Sleep patterns	1	1	0	0	0	0	0	0	0	0	0	2
Opportunities for personal growth and development	1	1	1	1	0	0	0	0	0	0	0	4
Social relevance of work-life	1	1	1	1	0	0	0	0	0	0	0	4
Physical health	1	1	1	1	1	1	1	0	0	0	0	7
Daily activities	1	1	0	1	1	1	1	0	0	0	0	6
Mental health	1	1	0	1	1	1	1	0	0	0	0	6
Job stress	1	1	1	1	1	1	1	1	0	0	0	8
Workplace safety	1	1	0	1	1	1	1	1	1	0	0	8
Fair compensation	1	1	1	1	1	1	1	1	0	1	1	10
Work overload	1	1	1	1	1	1	1	1	0	1	1	10
Dependence power	11	11	6	9	7	7	7	4	1	2	2	

<sup>§</sup> Determine the factor drive power and dependence power.



**Fig. 3.** ISM Model of factors affecting the QOL in the police officers.



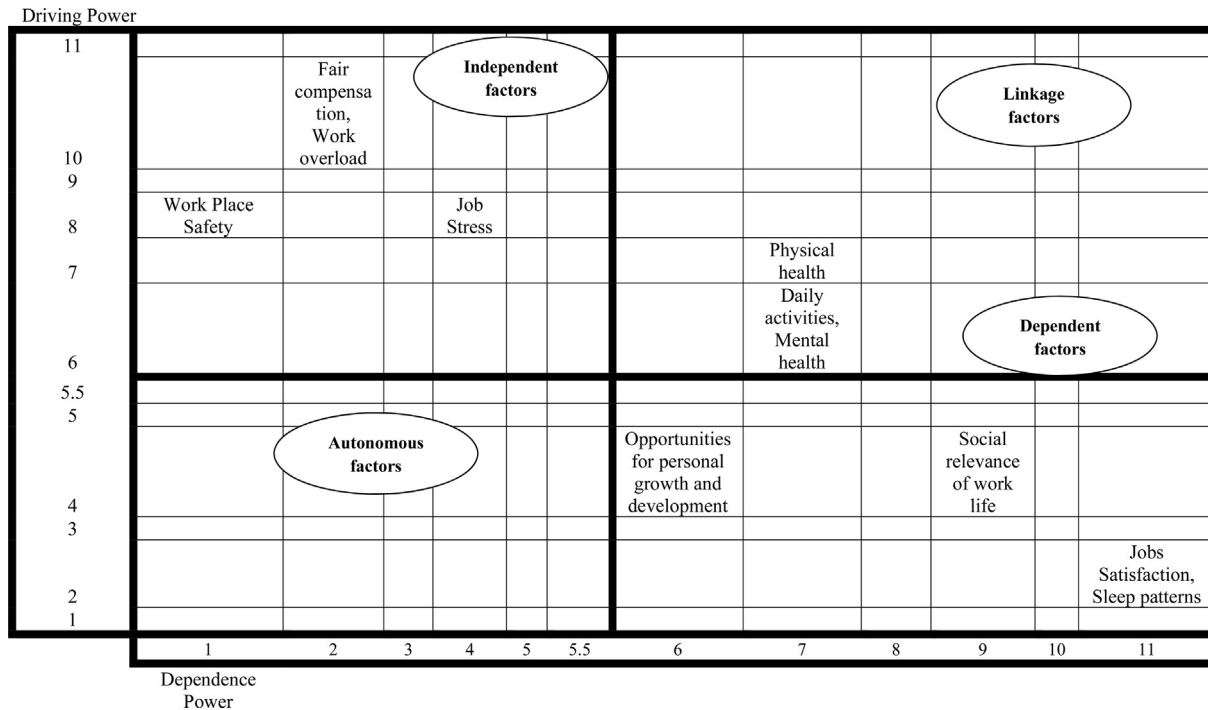


Fig. 4. MICMAC analysis.\* Categorization of factors in four clusters.

Table 9  
Total influence matrix “T”<sup>||</sup>

Factors	Jobs satisfaction	Workplace safety	Fair compensation	Opportunities for personal growth and development	Social relevance of work-life	Work overload	Physical health	Job stress	Daily activities	Sleep patterns	Mental health
Jobs Satisfaction	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	<b>0.101</b>	0.000
Workplace safety	<b>0.190</b>	0.000	0.000	0.039	<b>0.155</b>	0.000	<b>0.138</b>	<b>0.100</b>	<b>0.138</b>	<b>0.190</b>	<b>0.138</b>
Fair compensation	<b>0.224</b>	0.000	0.010	<b>0.156</b>	<b>0.184</b>	<b>0.101</b>	<b>0.153</b>	<b>0.111</b>	<b>0.153</b>	<b>0.224</b>	<b>0.153</b>
Opportunities for personal growth and development	<b>0.123</b>	0.000	0.000	0.010	<b>0.101</b>	0.000	0.000	0.000	0.000	<b>0.123</b>	0.000
Social relevance of work-life	<b>0.123</b>	0.000	0.000	<b>0.101</b>	0.010	0.000	0.000	0.000	0.000	<b>0.123</b>	0.000
Work overload	<b>0.224</b>	0.000	<b>0.101</b>	<b>0.156</b>	<b>0.184</b>	0.010	<b>0.153</b>	<b>0.111</b>	<b>0.153</b>	<b>0.224</b>	<b>0.153</b>
Physical health	<b>0.167</b>	0.000	0.000	<b>0.116</b>	<b>0.137</b>	0.000	0.023	0.000	<b>0.114</b>	<b>0.167</b>	<b>0.114</b>
Job stress	<b>0.184</b>	0.000	0.000	<b>0.128</b>	<b>0.150</b>	0.000	<b>0.125</b>	0.000	<b>0.125</b>	<b>0.184</b>	<b>0.125</b>
Daily activities	<b>0.156</b>	0.000	0.000	0.024	<b>0.127</b>	0.000	<b>0.114</b>	0.000	0.023	<b>0.156</b>	<b>0.114</b>
Sleep patterns	<b>0.101</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000
Mental health	<b>0.156</b>	0.000	0.000	0.024	<b>0.127</b>	0.000	<b>0.114</b>	0.000	<b>0.114</b>	<b>0.156</b>	0.023

**Bold values** are those which are more than the threshold value i.e. 0.0681.

<sup>||</sup> The overall value in matrix T indicates how one element impacts other factors. Threshold value is calculated based on this matrix.

### 3.2. MICMAC analysis

MICMAC analysis, i.e. “cross-impact matrix multiplication” applied to classification was developed by Godet [67]. It is based on “multiplication properties of matrices” to evaluate the power of the factors. The purpose of MICMAC analysis is to identify the variables according to their driving power and dependence. There are four clusters of factors. The first group assumes poor driving ability and a low dependence on “autonomous factors.” These variables are frequently isolated from the system, which has just a few extremely strong links. The second group is made up of “dependent factors,” which have a high degree of dependence and a low driving force. The third cluster consists of “link factors” with high driving power and dependence. These factors are also referred to be

uncontrollable. The fourth type consists of “independent factors,” which have a strong driving force but a low dependence. A component having a high driving power is known as the “key factor” in the group of independent factors [52,68]. The “drive and dependence power” of factors are depicted in Table 7 and shown in Fig. 4.

The factors fair compensation, work overload, workplace safety, and job stress lie in the independent cluster which has “high driving and less dependence power”. The factors Physical health, Daily activities, and Mental health lie in the linkage cluster which has high driving and dependence power. The factors Opportunities for personal growth and development, Social relevance of work life, Jobs Satisfaction, and Sleep patterns lie in the dependent cluster which has “low driving and high dependence power”.

**Table 10**  
The values of D + R and D-R<sup>†</sup>

Factors	Sum of row (D) "influence given index"	Sum of column (R) "influence received index"	Horizontal axis	Vertical axis	Cause/effect
	Di	Ri	Di + Ri	Di-Ri	
Jobs Satisfaction	0.1111	1.6586	1.7697	-1.5475	Effect
Workplace Safety	1.0863	0.0000	1.0863	1.0863	Cause
Fair compensation	1.4690	0.1111	1.5801	1.3579	Cause
Opportunities for personal growth and development	0.3580	0.7538	1.1118	-0.3957	Effect
Social relevance of work life	0.3580	1.1752	1.5333	-0.8172	Effect
Work overload	1.4690	0.1111	1.5801	1.3579	Cause
Physical health	0.8364	0.8181	1.6545	0.0184	Cause
Job stress	1.0201	0.3222	1.3423	0.6978	Cause
Daily activities	0.7130	0.8181	1.5310	-0.1051	Effect
Sleep patterns	0.1111	1.6586	1.7697	-1.5475	Effect
Mental health	0.7130	0.8181	1.5310	-0.1051	Effect

<sup>†</sup> To find the cause and effect factors of QOL.

3.3. DEMATEL analysis

In this section, factors affecting QOL of police officers are classified into the "cause groups and the effect groups" with the help of DEMATEL methodology as discussed in the methodology [69].

Matrix A is developed as per equation 1 and normalized initial direct influence matrix is developed as per equation 2 and 3. Total influence matrix, T is computed as per equation 4 and presented in Table 9. The threshold value ( $\alpha$ ), i.e., 0.0681 is computed as per the equation 8 which is the average of Total influence matrix (T). In the total influence matrix, the threshold value represents how one factor influences other factors; thus, the threshold value distinguishes between significant and insignificant results [70]. The

values of  $t_{ij}$  in Table 9 that were larger than threshold value (0.0681) were displayed in bold, indicating the interaction between them e.g. the value of Jobs Satisfaction factor (1) to Sleep patterns (10) is greater than the threshold value i.e.  $t_{110}$  (0.101) >  $\alpha$  (0.0681). Table 10 shows the values of "influence given index" D i.e. the sum of rows and "influence received index" R i.e. the sum of columns of the total influence matrix, T of Table 9.

The importance of factors affecting QOL is revealed by (Di + Ri) values. Based on Table 10, job satisfaction and sleep patterns are the most important factors with the largest (Di + Ri) value of 1.7697, whereas workplace safety is the least important factor with the smallest (Di + Ri) value (1.0863). These empirical results show that experts attach more importance to job satisfaction (1.7697), sleep

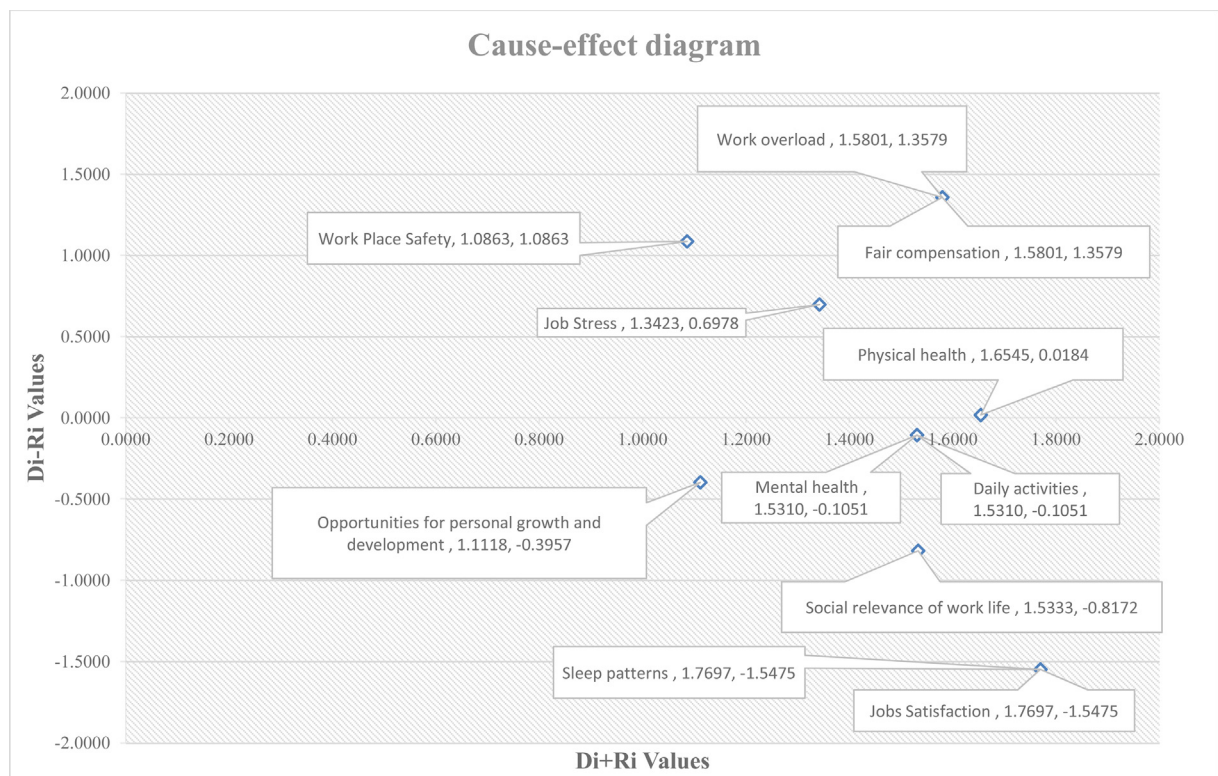


Fig. 5. Cause-effect diagram of QOL factors.

patterns (1.7697), and fair compensation (1.5801); however, less on job stress (1.3423), opportunities for personal growth and development (1.1118), and workplace safety (1.0863).

Based on (Di - Ri) values, the QOL factors are divided into cause group and effect group. If the value of (Di - Ri) is positive or net cause, such factors are classified in the cause group and directly affect the others. The highest (Di - Ri) factors also have the greatest direct impact on the others. In this research, workplace safety, fair compensation, work overload, job stress, and physical health are classified in the cause group, having the (Di - Ri) values of 1.0863, 1.3579, 1.3579, 0.6978, and 0.0184, respectively.

If the value of (Di - Ri) is negative or net receive, such factors are classified in the effect group and are largely affected by the others. For this research study, job satisfaction, opportunities for personal growth and development, social relevance of work life, daily activities, sleep patterns, and mental health are categorized in the effect group, with the (Di - Ri) values as shown in Table 10.

A cause–effect diagram is thus established based on the values of prominence ( $D + R$ ) as the abscissa and relation ( $D - R$ ) as the ordinate and is depicted in Fig. 5. The 11 factors were categorized in two groups i.e. “cause group and effect group,” based on ( $D - R$ ) values.

Results show that “fair compensation, work overload, workplace safety and job stress” are positioned at the top and may be considered as the highest/top-level factors. MICMAC analysis also shows that these factors lie in the independent cluster which has high driving power. This result was confirmed by the DEMATEL analysis that these factors are placed in the cause group, i.e., directly affecting the others. Hence, these factors are the key factors. “Physical health, daily activities, and mental health” are the middle-level factors. “Job satisfaction, sleep patterns, opportunities for personal growth and development, and social relevance of work-life” are placed at the lowest level in the results of the ISM as well as in the DEMATEL.

#### 4. Discussion

Police is a manpower intensive organization, and its performance depends on the work done by officers to a great extent. QOL is a multidimensional concept related to a person's well-being. This study analyzed the factors on which the QOL of police officers depend. Two different methodologies were used in this process. First, we implemented ISM with MICMAC analysis. The second method utilized the DEMATEL technique.

In a first phase, interpretive structural modeling (ISM) is applied to construct QOL of police officers into a hierarchical structure. In the next step, cross-impact matrix multiplication (MICMAC) analysis is done to categorize QOL of police officers in terms of their importance. DEMATEL was deployed to validate the ISM and MICMAC results [42,60,71,72].

These techniques, though powerful, have not been previously used in the context of police organizations in India. This study introduces the use of these new techniques to measure an important aspect of a police officer's well-being, namely, the QOL.

Police is a manpower intensive organization, and the performance of the organization depends in large part on optimal functioning of officers. The findings of the study revealed the factors on which the QOL of officers depend. The revealed factors are like those found in other similar studies. Our findings are consistent with findings of the previous studies like da Silva, Hernandez [24], who recommended that Military Police personnel should exercise regularly to improve their “physical fitness, health, job performance, and quality of life.” High levels of job stress or occupational stress are relatively more common among police officers who are depressed, and those who are depressed have a lower QOL in broad sense [2,21].

This suggests that Indian police managers need to focus on improving these underlying factors as in other countries if they want to enhance QOL of officers.

Through ISM methodology the reachability matrix was arrived at using the SSIM. The final hierarchical structural model brought up three categories of factors affecting QOL. The first and the most important category included fair compensation, work overload, workplace safety, and job stress as the key factors. The second category of factors included physical health, daily activities, and mental health. The third category of factors that are the least important are job satisfaction, sleep patterns, opportunities for personal growth and development, and social relevance of work-life. “Fair compensation, safe and healthy working conditions, opportunities for personal growth and development, satisfaction of social needs at work, and the social relevance of work life” have all been presented as elements of QOL [35]. Bélanger and Blanchette [73] also reported that tiredness and sleep is the most stressful part of the jobs. Life satisfaction among police officers was studied by Lambert, Qureshi [74] who looked at factors such as job stress, job stress, job involvement, and organizational commitment.

The MICMAC analysis usually suggests four categories of factors, namely, autonomous factors, dependent factors, link factors, and independent factors. In the present study, no autonomous factors were found. The dependent factors (with low driving power and high dependence power) were job satisfaction, opportunities for personal growth, social relevance of work life, and sleep patterns. The linkage factors (with high driving power and high dependence) were physical health, daily activities, and mental health. Finally, the independent factors (with high driving power and low dependence) were workplace safety, fair compensation, work overload, and job stress.

The results obtained with DEMATEL technique were the same as obtained using the ISM and MICMAC as detailed in the results section.

From the driving and dependence power diagram, considerable knowledge can be obtained about the appropriate significance and linkages of the factors affecting QOL. The relationships between multiple factors that influence the QOL of officers are important for the police department as they provide an opportunity to enhance the QOL and thereby bring about higher performance of the officers as well as the agency.

As a result of their jobs, police officers are exposed to a variety of professional and operational stressors, rendering them susceptible to psychological well-being issues. Therefore, social support is recognized to mitigate the negative effects of high stress [75].

##### 4.1. Implications of research

The ISM model illustrated key factors influencing the QOL of the police officers are interconnected and influence each other. QOL-related concerns are critical because they can predict the ability of a person to maintain an active lifestyle and gain long-term well-being and good health. The cause and effect diagram can greatly help in visualizing this concept and officers can further prioritize the factors affecting QOL in police officers by understanding the interrelationships among them in terms of how one factor can influence the other as well as its overall impact on the system. This analysis depicts the acute need for a model that can quantify the interconnections between these variables. In this study, a comprehensive model illustrating interrelationships among various factors influencing the QOL has been developed so that the QOL of police officers may be improved.

This study provides adequate pointers to policy makers to introduce organizational changes which impact the factors affecting QOL. The study also indicates the relative importance of the causal factors affecting QOL, which may be utilized by individual police officers as well to take remedial action.

#### 4.2. Limitations and future scope

The present study identifies 11 factors that affect the QOL of police officers, and a model is developed with DEMATEL, ISM, and MICMAC analysis. It is possible that some other relevant factors have not been incorporated and classified. The present study is based on entirely subjective judgments of few experts. The result thus obtained is a kind of personal judgment and any prejudices of the experts might affect the conclusion. The future scope of this study may expand to identifying most significant enablers that are related to QOL of police officers in India as well as abroad. Further, structural equation modeling (SEM), MCDM techniques like (ANP and AHP) may also be used for causal relation among the factors and for the statistical validation of the developing hypothetical model.

QOL is dependent on the context and culture of the geography where the police department is located. This may affect the generalization of the results. Our study was conducted in the Indian state of Haryana. More such studies are needed in other Indian states and other countries to establish the universality of the factors affecting QOL and their weights and relationships.

The model developed in this study clearly illustrates the complex relationships between the factors affecting QOL and demonstrates the direct and indirect relationships between them. Our results may not be perfectly accurate on account of the limitations as mentioned, but they can provide guidelines for the selection of factors and establishment of models for improving the QOL of police officers. At the very least, this study may be used as a starting point to enhance and refine the techniques to be used in future studies of QOL.

#### 5. Conclusion

The importance of the human agency in police departments is well understood. For optimum performance it is required that the officers are physically and mentally fit. This study further enhances the concept of fitness and happiness and utilizes the emerging concept of QOL. A higher QOL leads to greater self-satisfaction of officers as well as leads to higher organizational performance.

The ISM model illustrated the key factors influencing the QOL of the police officers, interconnections between them, and how they influence each other. The study concludes that the top factors which affect QOL of police officers are Fair compensation, Work overload, Workplace safety and Job Stress. QOL-related concerns are critical because they are associated with the ability of an officer to maintain his positive life outlook and retain long-term well-being and good health. The cause-and-effect diagram can greatly help in visualizing this concept. Police managers can use these results as it helps them prioritize the factors affecting QOL and enhances understanding of the interrelationships among them. By studying how one factor influences the other, the overall impact on the system can be understood in a comprehensive manner.

This study highlights the need for a model that can quantify the interconnections between the variables that affect the QOL of police officers. In this study, a comprehensive model depicting interrelationships among various factors influencing the QOL has been developed so that the QOL of police officers may be improved. This is likely to help policy makers not only understand the importance of QOL, but design suitable interventions that can enhance this important parameter.

#### Conflict of interest

The authors declare that they have no conflict of interest.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.shaw.2022.07.004>.

#### References

- [1] Tyagi A, Dhar RL. Factors affecting health of the police officials: mediating role of job stress. *Policing: An International Journal of Police Strategies & Management*. 2014;37(3):649–64.
- [2] Chen H-C, Chou FH-C, Chen M-C, Su S-F, Wang S-Y, Feng W-W, Chen P-C, Lai J-Y, Chao S-S, Yang S-L, Tsai T-C, Tsai K-Y, Lin K-S, Lee C-Y, Wu H-C. A survey of quality of life and depression for police officers in Kaohsiung, Taiwan. *Qual Life Res* 2006;15(5):925–32.
- [3] Paoline III EA. Taking stock: toward a richer understanding of police culture. *J Crim Justice* 2003;31(3):199–214.
- [4] Gershon RR, Lin S, Li X. Work stress in aging police officers. *J Occup Environ Med* 2002;44(2):160–7.
- [5] Glaveli N, Karassavidou E, Zafiroopoulos K. Relationships among three facets of family-supportive work environments, work-family conflict and job satisfaction: a research in Greece. *Int J Human Resource Manage* 2013;24(20):3757–71.
- [6] Lambert AD, Marler JH, Gueutal HG. Individual differences: factors affecting employee utilization of flexible work arrangements. *J Vocat Behav* 2008;73(1):107–17.
- [7] Warren JA, Johnson PJ. The impact of workplace support on work-family role strain. *Fam Relat* 1995:163–9.
- [8] Walton RE. Quality of working life: what is it. *Sloan Manag Rev* 1973;15(1):11–21.
- [9] Narehan H, Hairunnisa M, Norfadzillah RA, Freziameella L. The effect of quality of work life (QWL) programs on quality of life (QOL) among employees at multinational companies in Malaysia. *Procedia-Soc Behav Sci* 2014;112:24–34.
- [10] Sahni J. Exploring what constitutes 'quality' in quality of work life for female employees. *Int J Qual Res* 2017;11(4):785–98.
- [11] Akdere M. Improving quality of work-life implications for human resources. *Business Rev Cambridge* 2006;6(6):173–7.
- [12] Bowling A, Gabriel Z, Dykes J, Dowding LM, Evans O, Fleissig A, Banister D, Sutton S. Let's ask them: a national survey of definitions of quality of life and its enhancement among people aged 65 and over. *Int J Aging Human Develop* 2003;56(4):269–306.
- [13] WHO. World Health organization constitution. Geneva, Switzerland: WHO; 1948.
- [14] Jenkinson C. Quality of life. *Encyclopedia Britannica*; 2020.
- [15] Qureshi H, Lambert EG, Frank J. The relationship between stressors and police job involvement. *Int J Police Sci Manag* 2019;21(1):48–61.
- [16] Deschamps F, Paganon-Badinier I, Marchand A-C, Merle C. Sources and assessment of occupational stress in the police. *J Occup Health* 2003;45(6):358–64.
- [17] Alexopoulos EC, Palatsidi V, Tigani X, Darviri C. Exploring stress levels, job satisfaction, and quality of life in a sample of police officers in Greece. *Safety Health Work* 2014;5(4):210–5.
- [18] Trombka M, Demarzo M, Campos D, Antonio SB, Cicuto K, Walcher AL, García-Campayo J, Schuman-Olivier Z, Rocha Neusa S. Mindfulness training improves quality of life and reduces depression and anxiety symptoms among police officers: results from the POLICE study—a multicenter randomized controlled trial. *Front Psychiatry* 2021;12:112.
- [19] Campbell A, Converse PE, Rodgers WL. The quality of American life: perceptions, evaluations, and satisfactions. New York: Russell Sage Foundation; 1976.
- [20] Wright TA, Bonett DG. Job satisfaction and psychological well-being as nonadditive predictors of workplace turnover. *J Manage* 2007;33(2):141–60.
- [21] Kale A, Gedik Z. Quality of life in riot police: links to anger, emotion regulation, depression, and anxiety. *Appl Res Qual Life* 2020;15(1):107–25.
- [22] Costa FGd, Vieira LS, Cócara MG, Azzolin KdO, Dal Pai D, Tavares JP. Quality of life, health conditions and life style of civil police officers. *Rev gaucha enferm* 2020:41.
- [23] Wu X, Liu Q, Li Q, Tian Z, Tan H. Health-related quality of life and its determinants among criminal police officers. *Int J Environ Res Public Health* 2019;16(8):1398.
- [24] da Silva FC, Hernandez SSS, Arancibia BAV, da Silva Castro TL, Gutierrez Filho PJB, da Silva R. Health-related quality of life and related factors of military police officers. *Health Qual Life Outcomes* 2014;12(1):60.
- [25] Andrade ER, Sousa ERd, Minayo MCdS. Self-esteem and quality of life: essential for the mental health of police officers. *Ciê Saúde Colet* 2009;14(1):275–85.
- [26] Kutlu R, Civi S, Karaoğlu O. The assessment of quality of life and depression among police officers. *Türk Klin Tıp Bilimleri Dergisi* 2009;29(1):8–15.
- [27] Lipp MEN. Stress and quality of life of senior Brazilian police officers. *Span J Psychol* 2009;12(2):593–603.
- [28] Kutlu R, Çivi S, Karaoğlu O. The effects of depression and smoking upon the quality of life of municipal police officers. *Marmara Med J* 2008;21(3):220–30.
- [29] line Slotte P, Twisk JW, Smid N, Huizink AC, Witteveen AB, Van Mechelen W, Smid T. Health-related quality of life of firefighters and police officers 8.5 years after the air disaster in Amsterdam. *Qual Life Res* 2007;16(2):239–52.



- [30] Golub A, Johnson BD, Taylor A, Eterno J. Quality-of-life policing. *Policing* 2003;26(4):690–707.
- [31] Katz CM, Webb VJ, Schaefer DR. An assessment of the impact of quality-of-life policing on crime and disorder. *Just Quarter* 2001;18(4):825–76.
- [32] Dhamija P, Gupta S, Bag S. Measuring of job satisfaction: the use of quality of work life factors. *Benchmarking Int J* 2019;26(3):871–92.
- [33] Lambert EG, Qureshi H, Frank J, Klahm C, Smith B. Job stress, job involvement, job satisfaction, and organizational commitment and their associations with job burnout among Indian police officers: a research note. *J Police Crim Psychol* 2018;33(2):85–99.
- [34] Qureshi H, Frank J, Lambert EG, Klahm C, Smith B. Organisational justice's relationship with job satisfaction and organisational commitment among Indian police. *Police J* 2017;90(1):3–23.
- [35] Easton S, Van Laar D, Marlow-Vardy R. Quality of working life and the police. *Management* 2013;3(3):135–41.
- [36] Davies M, Dempster M, Malone A. Do people with diabetes who need to talk want to talk? *Diabet Med* 2006;23(8):917–9.
- [37] Diestel S, Schmidt K-H. Mediator and moderator effects of demands on self-control in the relationship between work load and indicators of job strain. *Work Stress* 2009;23(1):60–79.
- [38] Cannon W. Recent studies of bodily effects of fear, rage, and pain. *J Philos Psychol Sci Methods* 1914;11(6):162–5.
- [39] Spasić A, Radovanović RV, Đorđević AC, Stefanović N, Cvetković T. Quality of life in type 2 diabetic patients. *Acta Fac Med Naissensis* 2014;31(3):193–200.
- [40] Huang ES, Brown SE, Ewigman BG, Foley EC, Meltzer DO. Patient perceptions of quality of life with diabetes-related complications and treatments. *Diabetes Care* 2007;30(10):2478–83.
- [41] Murry Jr JW, Hammons JO. Delphi: a versatile methodology for conducting qualitative research. *Rev High Edu* 1995;18(4):423–36.
- [42] Priya SS, Priya MS, Jain V, Dixit SK. An assessment of government measures in combatting COVID-19 using ISM and DEMATEL modelling. *Benchmarking Int J* 2022;29(5):1429–51.
- [43] Singh R, Bhanot N. An integrated DEMATEL-MMDE-ISM based approach for analysing the barriers of IoT implementation in the manufacturing industry. *Int J Prod Res* 2020;58(8):2454–76.
- [44] Goel P, Sharma N, Mathiyazhagan K, Vimal K. Government is trying but consumers are not buying: a barrier analysis for electric vehicle sales in India. *Sustain Prod Consum* 2021;28:71–90.
- [45] Mishra R. An analysis of factors influencing omnichannel retailing adoption using ISM-DEMATEL approach: an Indian perspective. *Int J Retail Distrib Manag* 2021;49(4):550–76.
- [46] Vishnu CR, Sridharan R, Ram Kumar PN, Regi Kumar V. Analysis of the operational risk factors in public hospitals in an Indian state: a hybrid DEMATEL–ISM–PROMETHEE approach. *Int J Health Care Qual Assur* 2020;33(1):67–88.
- [47] Chauhan A, Singh A, Jharkharia S. An interpretive structural modeling (ISM) and decision-making trail and evaluation laboratory (DEMATEL) method approach for the analysis of barriers of waste recycling in India. *J Air Waste Manag Assoc* 2018;68(2):100–10.
- [48] Kumar A, Dixit G. An analysis of barriers affecting the implementation of e-waste management practices in India: a novel ISM-DEMATEL approach. *Sustain Prod Consum* 2018;14:36–52.
- [49] Jain S, Ajmera P, Jain V. Modelling and analysis of the classroom communication barriers using ISM: an Indian teacher's perspective. *Int J Knowl Learn* 2022;15(3):253–73.
- [50] Mittal P, Ajmera P, Jain V, Aggarwal G. Modeling and analysis of barriers in controlling TB: developing countries' perspective. *Int J Health Govern* 2021;26(4):362–83.
- [51] Priya MS, Jain V, Kabiraj S, Priya SS. Modelling the factors affecting global economy during COVID-19 using ISM approach. *Int J Serv Econ Manag* 2021;12(3):294–316.
- [52] Ajmera P, Jain V. Modeling the factors affecting the quality of life in diabetic patients in India using total interpretive structural modeling. *Benchmarking Int J* 2019;26(3):951–70.
- [53] Ajmera P, Jain V. A fuzzy interpretive structural modeling approach for evaluating the factors affecting lean implementation in Indian healthcare industry. *Int J Lean Six Sigma* 2019;11(2):376–97.
- [54] Kannan G, Pokharel S, Sasi Kumar P. A hybrid approach using ISM and fuzzy TOPSIS for the selection of reverse logistics provider. *Resour Conserv Recycl* 2009;54(1):28–36.
- [55] Mathiyazhagan K, Govindan K, NoorulHaq A, Geng Y. An ISM approach for the barrier analysis in implementing green supply chain management. *J Clean Prod* 2013;47:283–97.
- [56] Jain V, Raj T. Modeling and analysis of FMS performance variables by ISM, SEM and GTMA approach. *Int J Prod Econ* 2016;171:84–96.
- [57] Ranjan R, Chatterjee P, Chakraborty S. Performance evaluation of Indian Railway zones using DEMATEL and VIKOR methods. *Benchmarking Int J* 2016;23(1):78–95.
- [58] Alaei AAR, Alroaia YV. Identifying and prioritizing the factors affecting and affected by the performance of small and medium enterprises by using DEMATEL technique (The case study of a province in Iran). *Indian J Sci Technol* 2016;9(6):1–9.
- [59] Tzeng G-H, Chiang C-H, Li C-W. Evaluating intertwined effects in e-learning programs: a novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert Syst Appl* 2007;32(4):1028–44.
- [60] Jain V, Ajmera P. Fuzzy TISM and DEMATEL approach to analyze lean variables in Indian healthcare industry. *Int J Process Manag Benchmarking* 2022;12(2):233–75.
- [61] Warfield JN. On arranging elements of a hierarchy in graphic form. *IEEE Trans Syst Man Cybernet* 1973;2(2):121–32.
- [62] Jain V, Raj T. Modelling and analysis of FMS productivity variables by ISM, SEM and GTMA approach. *Front Mech Eng* 2014;9(3):218–32.
- [63] Jain V, Raj T. Study of issues related to constraints in FMS by ISM, fuzzy ISM and TISM. *Int J Ind Syst Eng* 2021;37(2):197–221.
- [64] Jain V, Ajmera P. Modelling the factors affecting Indian medical tourism sector using interpretive structural modeling. *Benchmarking Int J* 2018;25(5):1461–79.
- [65] Jain V, Raj T. A hybrid approach using ISM and modified TOPSIS for the evaluation of flexibility in FMS. *Int J Ind Syst Eng* 2015;19(3):389–406.
- [66] Raj T, Attri R, Jain V. Modelling the factors affecting flexibility in FMS. *Int J Ind Syst Eng* 2012;11(4):350–74.
- [67] Godet M. From anticipation to action, A handbook of strategic prospective. Paris: Unesco Publishing; 1993.
- [68] Jain V, Ajmera P. Modelling the enablers of industry 4.0 in the Indian manufacturing industry. *Int J Prod Perform Manag* 2020;70(6):1233–62.
- [69] Jain V, Ajmera P. DEMATEL method for evaluating FMS variables in the Indian manufacturing industry. *Int J Process Manag Benchmarking* 2021;11(6):822–38.
- [70] Singh C, Singh D, Khamba J. Analyzing barriers of Green Lean practices in manufacturing industries by DEMATEL approach. *J Manuf Technol Manag* 2021;32(1):176–98.
- [71] Priya SS, Jain V, Priya MS, Dixit SK, Joshi G. Modelling the factors in the adoption of artificial intelligence in Indian management institutes. *Foresight* 2022.
- [72] Lamba K, Singh SP. Modeling big data enablers for operations and supply chain management. *Int J Logist Manag* 2018;29(2):629–58.
- [73] Bélanger K, Blanchette I. Stress and the interpretation of ambiguous faces in police officers. *Police Pract Res* 2022:1–14.
- [74] Lambert EG, Qureshi H, Frank J. The good life: exploring the effects job stress, job involvement, job satisfaction, and organizational commitment on the life satisfaction of police officers. *Int J Police Sci Manag* 2021;23(3):279–92.
- [75] Nero JW, Campbell MA, Doyle JN, Meagher J. The link between social support and psychological vulnerability among Canadian police officers. *J Police Crim Psychol* 2022;37(2):377–91.