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RANKING OF DIFFERENT DEPARTMENTS OF GHORI CEMENT FACTORIES BASED ON THE NEGATIVE EFFECTS OF THE COVID-19 VIRUS BY USING AHP AND SAW METHODS IN 2023-2024 - A CASE STUDY

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ABSTRACT

The covid-19 virus is one of the most dangerous and deadly viruses in the world, which has been killing people for several years. Afghanistan is one of the poor countries that has less control over this virus, so it had the highest number of deaths in different sectors. The purpose of this research is to prioritize different department of Ghori cement factories due to being affected by the negative effects of the spread of the Covid-19 virus using AHP[2] and SAW[3] methods. The study is cross-sectional-descriptive-analytical and based on a survey of experts and employees of Ghori Cement Factory by ordering and distributing questionnaires using AHP and SAW methods, in the framework of five options and fifteen criteria. In general, in this research, a model of the decision-making structure based on AHP and SAW methods has been introduced to make a decision regarding the impact of the Covid-19 virus on different parts of Ghori cement factories. SAW method has been used as an efficient and effective method in prioritizing options.

The results obtained from this research show that the health department with a weight of 0.27 is the most affected by the spread of the Covid-19 virus and the administrative department with a weight of 0.15 is less affected by this phenomenon and other departments according to the weights they have been affected by this virus in different places.

KEYWORDS*: AHP method, Afghanistan, cement, Covid-19 virus, Ghori cement factories, SAW method*

1. INTRODUCTION

The newly discovered corona virus that causes the infectious disease Covid-19. This emerging virus and the disease caused by it were unknown until the beginning of the outbreak in December 2019 in the city of Wuhan, China. But the most common symptoms of this disease are fever, fatigue and dry cough[1]. Some patients may have other symptoms such as pain and bruising, nasal congestion, runny nose, sore throat or diarrhoea. These symptoms are usually mild and their onset is gradual. Some affected people may not experience any of these symptoms and may not feel sick.

The scientific name of the corona virus is Coronaviruses, and it is a group of viruses belonging to the corona virus family, which cause disease by causing infection in the respiratory system of birds and mammals[2]. Coronaviruses were discovered in the 1960s and were continuously studied until the mid-1980s[3]. The origin of corona viruses is animals and this virus was transferred from camels to humans. According to researchers, horseshoe bats and pangolins are the primary natural source of the Covid-19 virus. Of course, other animals may also play a role in the spread of the mentioned virus[4]. Depending on the type of coronavirus, its transmission methods are different. In some cases, the methods of human-to-human transmission are similar to influenza through coughing and sneezing, however, the possibility of transmission in the open air is very limited[5]. Many efforts have been made to produce vaccines to

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[3] *Simple Additive Weighting*

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prevent diseases caused by coronaviruses. Currently, several companies from the United States of America, England, Germany, France, China, Japan, Russia, and Iran have developed various types of Covid-19 vaccines and they are injecting it. Antiviral drugs are also being investigated and tested[6]. Also, vaccines have been developed for different types of animal coronaviruses, including avian coronavirus and infectious gastroenteritis virus, which are not highly effective, but these vaccines have been able to reduce the rapid spread of the disease in animals to some extent[7].

Most patients (about 80%) recover without any special treatment. Almost one out of every six people infected with Covid-19 will become seriously ill and experience shortness of breath. In the elderly and people who have underlying diseases such as high blood pressure, heart diseases or diabetes, the possibility of worsening of the disease is higher[8]. Ghori Cement Factory, like a gathering center, has not been spared from the spread of this phenomenon and has caused huge financial and human losses in this area. During the outbreak of the mentioned virus, this production giant of the country was closed for several months in order to prevent the spread of the virus and the fight against it, because of which it suffered huge financial losses and also lost a number of its professional and honest employees and workers. In order to identify and diagnose the different parts of Ghori cement factories that have suffered more life and financial losses during the spread of the Covid-19 virus, the motivation for research has been found and using AHP and SAW methods, more vulnerable points will be identified. This research has been completed in the form of 15 criteria and 5 options. According to the steps of the mentioned methods, first, the opinions of the employees and workers of Ghori cement factories were collected using questionnaires, and then the weights of the criteria were calculated using the AHP method, and then the options were ranked using the SAW method (sections cement factories) is done.

2. RESEARCH MATERIALS AND METHODS

2-1. Research structure

In order to further explain each research, it is necessary to outline its general structure. Therefore, in this research, all the stages of the research are described in the form of the following flowchart.

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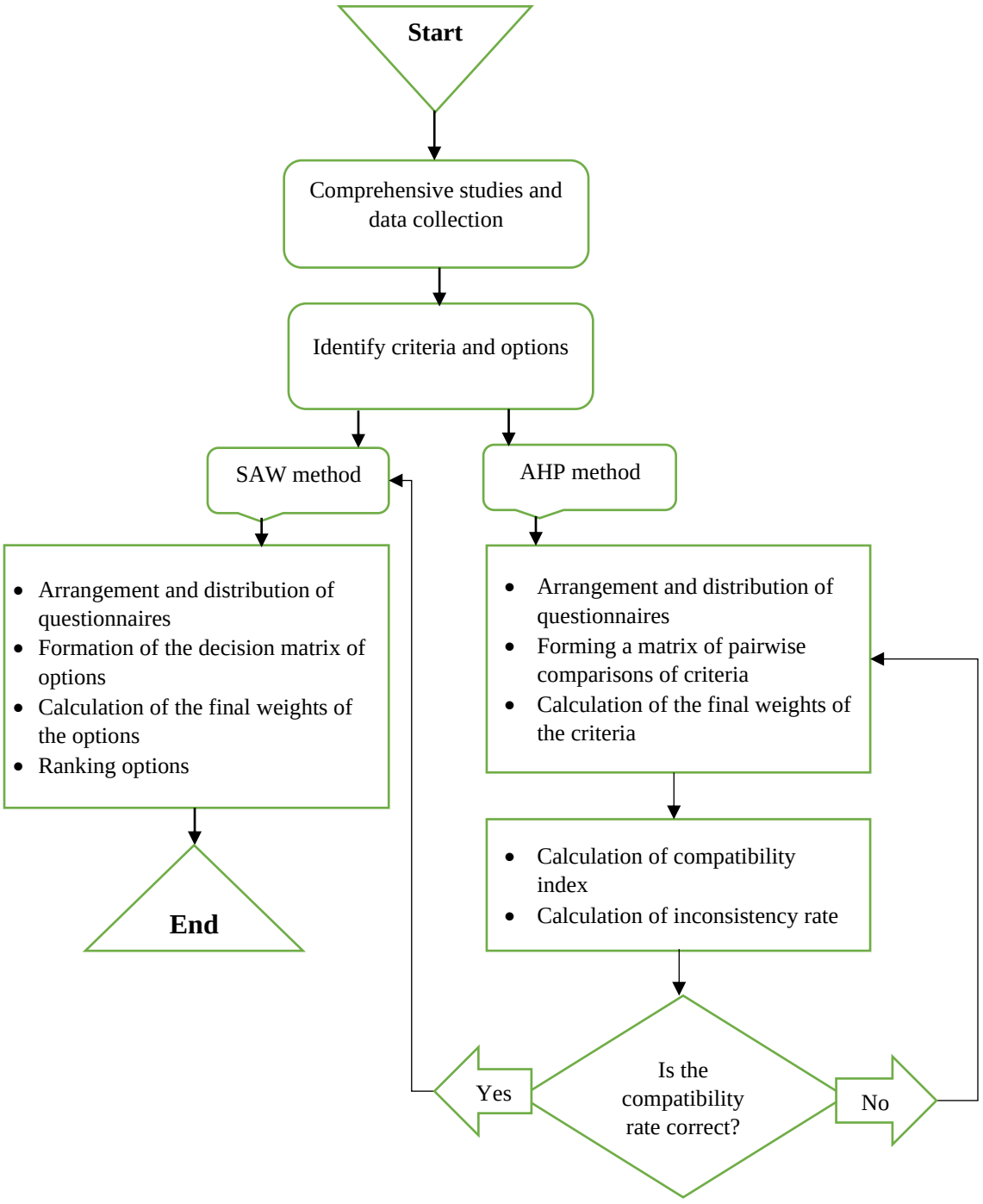

Figure 1: General flowchart of the research

2-2. Analysis Hierarchy Method (AHP)

The AHP method is a structured technique that was developed in 1972 by Thomas L. Saaty watch has been introduced to the world and has expanded a lot since then. This method is based on a matrix structure as well as components that give a close estimate of the weights of the criteria. This method has a lot of potential in decision-making issues and

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can be used in issues such as business, industry, health and education. This method helps to solve mental problems with the help of numerical topics[9]. The AHP method provides the basis for transforming complex problems into a logical and simpler hierarchy so that the planner can easily evaluate the options according to the criteria and sub-criteria. Basically, the users of the AHP method first place their desired decision-making problem in the form of a hierarchy in such a way that they can examine each of its branches independently (assuming there is no correlation between the criteria) and It is much easier to achieve the desired result through the steps of the AHP method[10]. In general, the hierarchical analysis process is as follows:

- Hierarchical structure design
- Pairwise comparisons of decision criteria
- Comparison of each option for each factor
- Extracting priorities from the comparative table
- Conclusion

After determining the hierarchy, pairwise comparison matrices should be determined based on the opinion of the decision maker[11]. This action is done for each level individually. In general, if the number of options and criteria are equal to m and n respectively, then the pairwise comparison matrices of the options will be $m \times m$ and the pairwise comparison matrix of the criteria will be an $n \times n$ matrix[12].

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \qquad a_{ij} = (a_{ik}) \times (a_{kj}) \qquad 1$$

If in the matrix of pairwise comparisons, the above relation is not valid only for one of k, j, i the matrix will be inconsistent. In general, the matrix of pairwise comparisons should have the following characteristics[13].

1. If we consider the matrix of pairwise comparisons $A = (a_{ij})_{n \times n}$, if $\{\tau_1, \tau_2, \dots, \tau_n\}$ are the eigenvalues of the matrix A, then we have:

$$\sum_{i=1}^{n} \tau_i = n \qquad 2$$

2. If $\tau_{max} = Max_i(\tau_i)$ and n is equal to the dimension of the pairwise comparison matrix, then we have:

$$\tau_{max} \geq n \qquad 3$$

If $\tau_{max} = n$, matrix A is consistent, and if $\tau_{max} > n$, it indicates matrix inconsistency. In inconsistent matrices, some eigenvalues can become negative, so it can be said that for the sum of eigenvalues to be equal to n, $\tau_{max} \geq n$ must be.

Calculating the weights of criteria has a very decisive role in solving decision-making problems. Weight calculation in the process of hierarchical analysis is discussed in two separate parts (relative weight and final weight)[14]. The methods of calculating the relative weight of the decision matrix are mainly divided into two groups (exact methods and approximate methods). In this research, the weights of the criteria have been calculated using approximate methods (row sum, column sum, arithmetic mean and geometric mean) [15]. First, the decision matrix should be normalized, I use the following relations to normalize the matrix.

The importance of calculating the inconsistency rate is in the initial confirmation of paired comparison data and their use in decision-making, because if the inconsistency rate is greater than 0.1, the data matrix of pairwise comparisons will have very low reliability. The Inconsistency Index ($I.I$) and the Inconsistency Ratio ($I.R$) are calculated from the following relationships:

$$I.I = \frac{\tau_{max} - n}{n-1} \qquad 4$$

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$$\tau_{max} = \frac{\sum_{i=1}^{n} \tau_{max}}{n} \quad 5$$

$$\tau_{max.i} = \frac{A \times W}{W_i} \quad 6$$

$$A_i = a_{ij} \times W_j \qquad i = 1, \qquad j = 1, \quad 7$$

$$I.R = \frac{I.I}{I.I.R} \quad 8$$

If $I.R \leq 0.1$, the compatibility of the system is acceptable, to obtain the inconsistency rate, we consider the value of the Inconsistency Index of Random matrix ($I.I.R$) according to the dimensions of the matrix, in the form of the following table:

Table 1: The Inconsistency Index of Random matrix value according to the dimensions of the matrix[16]

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I.I.R	0.0	0.0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	**1.59**

2-3. Simple Cumulative Weighting (SAW) method

In the SAW method, using the weighted average, we get the importance of each option and then choose the highest value as the best option[17]. The steps of this method are[18]:

- Formation of the decision matrix
- De-scaling of decision matrix using linear normalization method
- Formation of balanced matrix
- Select the top option

2-4. Identify Criteria and Options

In order to recognize and identify the criteria and options, first, according to the administrative organization of Ghori Cement Factory and interviews with competent officials of this department, five items were identified as related options, and then 15 items were selected as effective criteria, which are shown in the table (2) is explained in detail.

Table 2: Identified options and criteria

options	Criteria		
Technical and production department	Gravity and heaviness of work (A)	Working in an environment infected with the Covid-19 virus(B)	Use of tools and equipment infected with the Covid-19 virus (C)
Financial department	Low wages of employees (D)	Failure to pay employees' salaries on time(E)	Lack of financial ability to employees in case of absence from (F)
health department	Not wearing a mask (G)	Employees suffering from various previous diseases (H)	Covid-19 virus pandemic(I)
Cultural and social department	Participation in cultural and sports circles(J)	Labor strikes and demonstrations (K)	Internal and external trips of employees(L)
Administrative department	The employees are stained with drugs (M)	The age of employees(N)	Employees not using public holidays (O)

2.5 Determining the weights of the criteria using the AHP method

In order to determine the weights of the criteria, it is first necessary to draw the hierarchical analysis structure and then calculate the rest of the cases according to the steps of the method. The hierarchical structure is drawn and explained in Figure 2.

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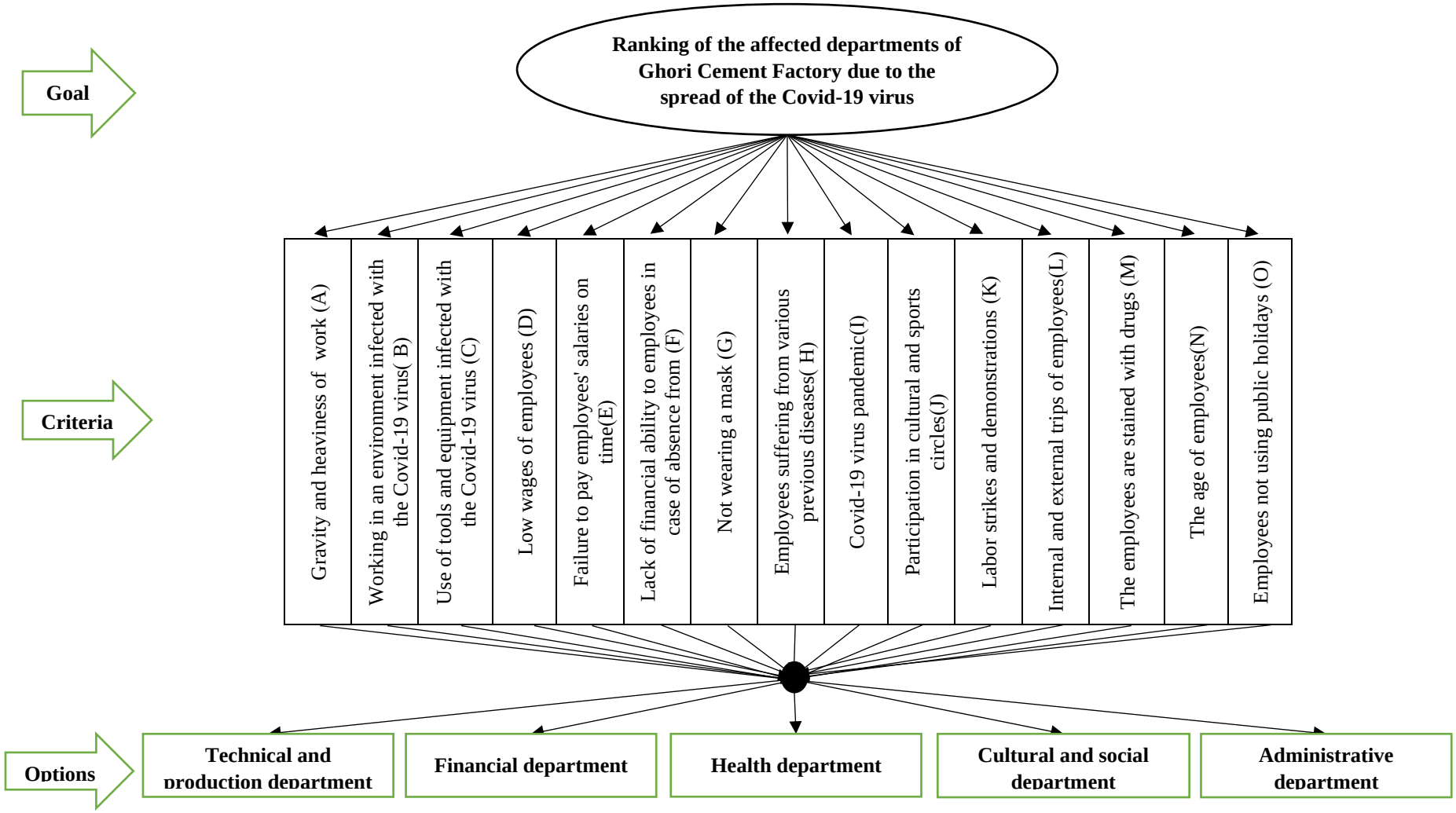

Figure 2: The general structure of Analytic Hierarchy Process

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In order to evaluate the preference of criteria and make expert decisions in the form of paired comparisons, it is necessary to define a range of numbers, the numbers defined to evaluate the priority of the criteria are explained in Table 3. The experts made paired comparisons using defined numbers and the decision matrix of paired comparisons was formed based on equation 1 and its results are explained in Table 4.

Table 3: Scoring scale to evaluate the priority of criteria

verbal expressions	Numerical description	Reverse the numbers
Very much	4	0.25
Much	2	0.5
similar	1	1
Low	0.5	2
Very low	0.25	4

Table 4: Decision matrix of pairwise comparisons of criteria

Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	1.00	0.56	0.50	1.25	0.63	2.50	0.31	0.56	0.31	0.63	1.25	0.63	0.63	0.71	2.50
B	1.80	1.00	1.25	5.00	2.50	5.00	0.31	2.86	1.00	5.00	5.00	5.00	2.50	4.00	4.00
C	2.00	0.80	1.00	2.86	5.00	2.50	0.63	2.86	0.63	2.50	2.86	2.50	2.50	5.00	5.00
D	0.80	0.20	0.35	1.00	1.25	1.25	0.31	0.50	0.36	0.63	0.50	0.63	0.63	0.31	0.71
E	1.60	0.40	0.20	0.80	1.00	0.63	0.36	0.63	0.42	0.31	0.42	0.71	0.63	0.71	2.86
F	0.40	0.20	0.40	0.80	1.60	1.00	0.63	0.63	0.36	0.63	1.25	0.71	0.71	0.63	2.86
G	3.20	3.20	1.60	3.20	2.80	1.60	1.00	2.50	0.63	2.50	5.00	5.00	2.50	1.25	4.00
H	1.80	0.35	0.35	2.00	1.60	1.60	0.40	1.00	0.63	2.50	5.00	2.50	2.86	0.63	3.33
I	3.20	1.00	1.60	2.80	2.40	2.80	1.60	1.60	1.00	5.00	2.50	5.00	4.00	2.50	5.00
J	1.60	0.20	0.40	1.60	3.20	1.60	0.40	0.40	0.20	1.00	1.25	2.50	2.86	0.63	2.50
K	0.80	0.20	0.35	2.00	2.40	0.80	0.20	0.20	0.40	0.80	1.00	0.63	0.50	0.42	0.83
L	1.60	0.20	0.40	1.60	1.40	1.40	0.20	0.40	0.20	0.40	1.60	1.00	0.63	0.71	2.50
M	1.60	0.40	0.40	1.60	1.60	1.40	0.40	0.35	0.25	0.35	2.00	1.60	1.00	0.63	5.00
N	1.40	0.25	0.20	3.20	1.40	1.60	0.80	1.60	0.40	1.60	2.40	1.40	1.60	1.00	4.00
O	0.40	0.25	0.20	1.40	0.35	0.35	0.25	0.30	0.20	0.40	1.20	0.40	0.20	0.25	1.00
Sum of columns	23.20	9.21	9.20	31.11	29.13	26.03	7.79	16.37	6.97	24.24	33.22	30.20	23.73	19.37	46.10

The first decision matrix has been normalized and the weights of the criteria have been calculated using approximate methods (row sum, column sum and arithmetic mean), the results of which are explained in Table 5.

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Table 5: Normalized matrix and criteria weights

Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Average weights of criteria
A	0.04	0.06	0.05	0.04	0.02	0.10	0.04	0.03	0.04	0.03	0.04	0.02	0.03	0.04	0.05	**0.042**
B	0.08	0.11	0.14	0.16	0.09	0.19	0.04	0.17	0.14	0.21	0.15	0.17	0.11	0.21	0.09	**0.136**
C	0.09	0.09	0.11	0.09	0.17	0.10	0.08	0.17	0.09	0.10	0.09	0.08	0.11	0.26	0.11	**0.115**
D	0.03	0.02	0.04	0.03	0.04	0.05	0.04	0.03	0.05	0.03	0.02	0.02	0.03	0.02	0.02	**0.031**
E	0.07	0.04	0.02	0.03	0.03	0.02	0.05	0.04	0.06	0.01	0.01	0.02	0.03	0.04	0.06	**0.036**
F	0.02	0.02	0.04	0.03	0.05	0.04	0.08	0.04	0.05	0.03	0.04	0.02	0.03	0.03	0.06	**0.039**
G	0.14	0.35	0.17	0.10	0.10	0.06	0.13	0.15	0.09	0.10	0.15	0.17	0.11	0.06	0.09	**0.131**
H	0.08	0.04	0.04	0.06	0.05	0.06	0.05	0.06	0.09	0.10	0.15	0.08	0.12	0.03	0.07	**0.073**
I	0.14	0.11	0.17	0.09	0.08	0.11	0.21	0.10	0.14	0.21	0.08	0.17	0.17	0.13	0.11	**0.133**
J	0.07	0.02	0.04	0.05	0.11	0.06	0.05	0.02	0.03	0.04	0.04	0.08	0.12	0.03	0.05	**0.055**
K	0.03	0.02	0.04	0.06	0.08	0.03	0.03	0.01	0.06	0.03	0.03	0.02	0.02	0.02	0.02	**0.034**
L	0.07	0.02	0.04	0.05	0.05	0.05	0.03	0.02	0.03	0.02	0.05	0.03	0.03	0.04	0.05	**0.039**
M	0.07	0.04	0.04	0.05	0.05	0.05	0.05	0.02	0.04	0.01	0.06	0.05	0.04	0.03	0.11	**0.049**
N	0.06	0.03	0.02	0.10	0.05	0.06	0.10	0.10	0.06	0.07	0.07	0.05	0.07	0.05	0.09	**0.065**
O	0.02	0.03	0.02	0.05	0.01	0.01	0.03	0.02	0.03	0.02	0.04	0.01	0.01	0.01	0.02	**0.022**
																1.000

The weight matrix of the criteria is formed using equation 7, and then the amount of τ_{max} is calculated using equation 5, the results of which are included in table 6. In the following, in order to calculate the Inconsistency Index (I.I), equation 4 was used, and also the Inconsistency Ratio (I.R) was calculated using equation 8, the results of which are included in table 7, and the value of Inconsistency Index of Random (I.I.R) according to The dimensions of the matrix are selected from Table 2.

Table 6: The weighted matrix of the criteria and the amount of τ_{max}

Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	The sum of weights criteria	$\tau_{max.i}$
A	0.04	0.08	0.06	0.04	0.02	0.10	0.04	0.04	0.04	0.03	0.04	0.02	0.03	0.05	0.05	0.69	16.25
B	0.08	0.14	0.14	0.15	0.09	0.19	0.04	0.21	0.13	0.28	0.17	0.19	0.12	0.26	0.09	2.29	16.80
C	0.08	0.11	0.12	0.09	0.18	0.10	0.08	0.21	0.08	0.14	0.10	0.10	0.12	0.32	0.11	1.93	16.77
D	0.03	0.03	0.04	0.03	0.04	0.05	0.04	0.04	0.05	0.03	0.02	0.02	0.03	0.02	0.02	0.49	16.11
E	0.07	0.05	0.02	0.02	0.04	0.02	0.05	0.05	0.06	0.02	0.01	0.03	0.03	0.05	0.06	0.58	16.10
F	0.02	0.03	0.05	0.02	0.06	0.04	0.08	0.05	0.05	0.03	0.04	0.03	0.04	0.04	0.06	0.63	16.18
G	0.14	0.44	0.18	0.10	0.10	0.06	0.13	0.18	0.08	0.14	0.17	0.19	0.12	0.08	0.09	2.21	16.82
H	0.08	0.05	0.04	0.06	0.06	0.06	0.05	0.07	0.08	0.14	0.17	0.10	0.14	0.04	0.07	1.21	16.56
I	0.14	0.14	0.18	0.09	0.09	0.11	0.21	0.12	0.13	0.28	0.09	0.19	0.20	0.16	0.11	2.22	16.63
J	0.07	0.03	0.05	0.05	0.11	0.06	0.05	0.03	0.03	0.06	0.04	0.10	0.14	0.04	0.05	0.90	16.35
K	0.03	0.03	0.04	0.06	0.09	0.03	0.03	0.01	0.05	0.04	0.03	0.02	0.02	0.03	0.02	0.55	16.01
L	0.07	0.03	0.05	0.05	0.05	0.05	0.03	0.03	0.03	0.02	0.05	0.04	0.03	0.05	0.05	0.62	16.07
M	0.07	0.05	0.05	0.05	0.06	0.05	0.05	0.03	0.03	0.02	0.07	0.06	0.05	0.04	0.11	0.79	16.07
N	0.06	0.03	0.02	0.10	0.05	0.06	0.10	0.12	0.05	0.09	0.08	0.05	0.08	0.06	0.09	1.06	16.33
O	0.02	0.03	0.02	0.04	0.01	0.01	0.03	0.02	0.03	0.02	0.04	0.02	0.01	0.02	0.02	0.35	16.20
																$\sum \tau_{max.i}$	**245.24**
																τ_{max}	**16.35**

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Table 7: Inconsistency index and criteria inconsistency rate

Count	15
lambda max	16.35
Inconsistency Index (I.I)	0.10
Inconsistency Ratio (I.R.)	0.06
Inconsistency Index of Random (I.I.R.)	1.59

Since the inconsistency rate is equal to 0.06, it is less than its standard size (0.1). Therefore, we can say that our matrix of pairwise comparisons is compatible.

2.6 Ranking options by using SAW method

Since the weights of the criteria have been obtained using the AHP method, I use the SAW method to rank the options. According to the steps of the first method, it is necessary to define the range of numbers in order to give importance to the criteria compared to the options, the defined numbers are included in Table 8.

Table 8: Defined numbers to evaluate the importance of criteria compared to options

Definition	Intensity of importance
Equal importance	1
Moderate importance	2
Strong importance	3
Very strong	4
Extreme importance	5

After arranging and distributing the questionnaires, the experts have determined the importance of the criteria compared to the options based on the defined numbers and the decision matrix has been formed according to the results of the questionnaires and the use of relation 9, which includes table 9.

$$D = \begin{bmatrix} x_{11} & \cdots & x_{1j} & \cdots & x_{1n} \\ x_{i1} & \cdots & x_{ij} & \cdots & x_{in} \\ x_{m1} & \cdots & x_{mj} & \cdots & x_{mn} \end{bmatrix} \qquad 9$$

Table 9: Decision matrix

Options /Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Max/Min	max	max	max	min	min	min	max	max	max	max	max	max	max	max	min
Technical and production department	5	4	3	1.8	2.2	2	5	4	5	1	4	3	4	5	1.6
Finance Department	2	2	2	3	2	2.8	3	2	3	2	4	2	3	3	2.4
health department	2	5	5	1.4	2.2	2.4	5	4	5	2	2	2	5	4	1.6
Cultural and social department	1	2	1	1	1.8	1.6	2	2	2	4	4	3	3	2	1
Administrative department	1	2	1	1.2	2.2	2.4	3	1	3	2	3	3	2	1	2
Max/Min	**5**	**5**	**5**	**1**	**1.8**	**1.6**	**5**	**4**	**5**	**4**	**4**	**3**	**5**	**5**	**1**

After forming the decision matrix, the said matrix was normalized according to the positive and negative criteria and using relations 10 and 11 and its results are explained in table 10.

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- For positive criteria

$$r_{ij} = \frac{X_{ij}}{X_j^{max}} \qquad i = 1, \dots 5, \qquad j = 1, \dots .15 \qquad 10$$

- For negative criteria

$$r_{ij} = \frac{X_j^{min}}{X_{ij}} \qquad i = 1, \dots 5, \qquad j = 1, \dots .15 \qquad 11$$

Table 10: Normalized matrix

Options /Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Max/Min	max	max	max	min	min	min	max	max	max	max	max	max	max	max	min
Technical and production department	1.00	0.80	0.60	0.56	0.82	0.80	1.00	1.00	1.00	0.25	1.00	1.00	0.80	1.00	0.63
Finance Department	0.40	0.40	0.40	0.33	0.90	0.57	0.60	0.50	0.60	0.50	1.00	0.67	0.60	0.60	0.42
health department	0.40	1.00	1.00	0.71	0.82	0.67	1.00	1.00	1.00	0.50	0.50	0.67	1.00	0.80	0.63
Cultural and social department	0.20	0.40	0.20	1.00	1.00	1.00	0.40	0.50	0.40	1.00	1.00	1.00	0.60	0.40	1.00
Administrative department	0.20	0.40	0.20	0.83	0.82	0.67	0.60	0.25	0.60	0.50	0.75	1.00	0.40	0.20	0.50

According to the results of the above matrix and using equation 12, the weight matrix of the options was formed and based on that, the normalized weights of the options were calculated, the results of which are included in table 11.

$$A_i = \sum_{j=1}^{m} W_j \times \left(X_{ij}\right)_{normal} \qquad i = 1, \dots .5, \qquad j = 1, \dots 15 \qquad 12$$

Table 11: weight matrix and normalized weights of options

Options /Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	The sum weights of the options	Normalized weights of options
Normalized weights of criteria	0.042	0.136	0.115	0.031	0.036	0.039	0.131	0.073	0.133	0.055	0.034	0.039	0.049	0.065	0.022		
Technical and production department	0.04	0.11	0.07	0.02	0.03	0.03	0.13	0.07	0.13	0.01	0.03	0.04	0.04	0.06	0.01	**0.84**	**0.26**
Finance Department	0.02	0.05	0.05	0.01	0.03	0.02	0.08	0.04	0.08	0.03	0.03	0.03	0.03	0.04	0.01	**0.54**	**0.17**
health department	0.02	0.14	0.12	0.02	0.03	0.03	0.13	0.07	0.13	0.03	0.02	0.03	0.05	0.05	0.01	**0.87**	**0.27**
Cultural and social department	0.01	0.05	0.02	0.03	0.04	0.04	0.05	0.04	0.05	0.06	0.03	0.04	0.03	0.03	0.02	**0.54**	**0.16**
Administrative department	0.01	0.05	0.02	0.03	0.03	0.03	0.08	0.02	0.08	0.03	0.03	0.04	0.02	0.01	0.01	**0.48**	**0.15**

3.27	1.00

Recently, the ranking of options has been done according to their normalized weights, which is explained in Table 12, and the percentage of the negative effects of the Covid-19 virus on different parts of Ghori cement factories is explained in Figure 3.

Table 12: Ranking of options based on normalized weights

Options	Normalized weights of options	Ranking options
Technical and production department	0.26	2
Finance Department	0.17	3
health department	0.27	1
Cultural and social department	0.16	4
Administrative department	0.15	5

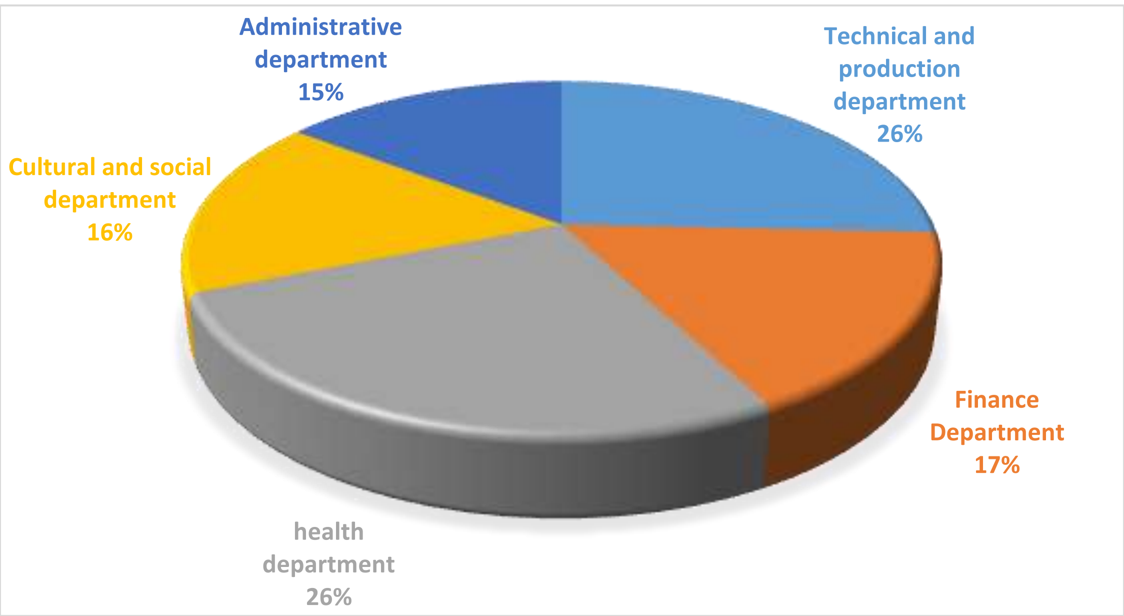

Figure 3: The extent effects of the Covid-19 virus on different departments of Ghori cement factories

3. DISCUSSION AND RESULTS

Since the Covid-19 virus was one of the most dangerous phenomena in the world in the years 2020-2021 and it took enough victims from the world. Afghanistan, as a poor country, is not safe from this ominous phenomenon and has paid more than other countries that have a good system and economy. Considering that the international community and the Afghan government made more efforts in this field and allocated specific budgets to all provinces to fight this virus, the spread of the Covid-19 virus at different levels caused financial and human losses Put. Ghori Cement Factory, as a production company in Baghlan province, was not safe from the spread of the Covid-19 virus and has suffered life and financial losses.

According to the administrative organization and interviews with the competent officials, we have divided all the parts of Ghori cement factories into five major departments, which include technical and production department, financial department, health department, cultural-social department and administrative department. Also, after interviewing the experts, among the 21 identified criteria, 15 have been established and determined as effective criteria, which is

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explained in Table 2. In order to determine the weights of the criteria, the Analytical Hierarchy (AHP) method has been used, and according to the steps of the mentioned method, the final weights of the criteria have been calculated, which includes Table 5. This method has a lot of potential in decision-making issues and can be used in issues such as business, industry, health and education. This method helps to solve mental problems with the help of numerical topics.

The ranking of options (parts of Ghori cement factories) is based on the SAW method. As a result, we found that the health department with a weight of 0.27 as the first option and the administrative department with a weight of 0.15 as the last option and other departments, according to their weights, have been placed in different positions on negative effects of the spread Covid-19 virus. And the ranking of options is shown in Table 12. Also, the percentage of negative effects of the spread Covid-19 virus on different parts of Ghori cement factories is explained in Figure 3.

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