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INSTITUTE OF SOCIAL SCIENCES

AN APPLICATION OF AHP-TOPSIS METHODOLOGY FOR DECISION MAKING: LOCATION SELECTION FOR STONE CRUSHER AND LANFILL OF WASTES AS A CASESTUDY

THESIS

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Ali BAKHSHIAN

To my parents

Farideh Shabani Moghadam and Gholamreza Bakhshian

And all of my freinds,Whihout whom none of my success whould be possible

FOREWORD

It`s with my deepest gratitude and warmest affection that dedicate this thesis
To Yrd.Doç.Dr.Nima Mirzaei Who has been constant source of knowledge and inspiration

October, 2017 **Ali Bakhshian**

TABLE OF CONTENT

Page

FOREWORD ..... **v**
TABLE OF CONTENT ..... **vi**
LIST OF TABLES ..... **ix**
LIST OF FIGURES ..... **x**
ÖZET ..... **xi**
ABSTRACT ..... **xii**
1 INTRODUCTION **1**
1.1 The choice of subject 1
1.2 The importance and necessity of research 2
1.3 The Territory of the obligatory study 2
1.4 Hypotheses 2
1.5 Thesis structure 2
2 LİTERATURE REVİEW **4**
2.1 Introduction 4
2.2 Decision-making criteria 4
2.3 Effective selection criteria Factory 5
2.4 Market 6
2.4.1 Raw materials 6
2.4.2 Work force 7
2.4.3 Rules and Regulations 7
2.4.4 Fuel 8
2.4.5 Power 8
2.4.6 Water 9
2.4.7 Transportation 9
2.4.8 Weather conditions and local 10
2.4.9 living conditions 10
2.4.10 Earth 11
2.4.11 Industrial history of the location 11
2.5 Effective criteria for selecting a processing plant 11
2.5.1 Effective criteria for site selection plant at the mine processing 16
2.6 Location 17
2.6.1 Concept of location 17
2.7 Location levels 18
2.8 importance of location 18
2.9 Diversity issues of location 18
2.9.1 Method for solving problems placement 19
2.10 Methods of site selection plant 19
3 METHODOLOGY: MCDM **21**
3.1 Introduction 21
3.2 plant site selection methods 22
3.2.1 Methods MCDM 22

3.2.2 Division multiple criteria decision making problems 23
3.3 The analytic hierarchy process (AHP) 26
3.3.1 Advantages of AHP... 30
3.3.2 Stage Analytic Hierarchy Process 31
3.3.3 The hierarchical graph.. 32
3.3.4 Weight elements in AHP.. 34
3.3.5 Rate of incompatibility... 40
3.4 The method is similar to Ideal 42
3.4.1 The advantages of this method include multi-criteria decision-making:43
3.4.2 Method steps similarity to ideal solution 44
3.4.3 Decision making matrix 44
3.4.4 Scale up the decision making matrix 44
3.4.5 Determining the weight matrix 45
3.4.6 Determining the scale up weight matrix 45
3.4.7 Find solutions ideal and anti-ideal 45
3.4.7 Calculate the distance from the ideal and anti-ideal solutions:.............. 45
3.4.8 Similarity index 46
4 DATA COLLECTİON 47
4.1 General information about Sarcheshmeh Copper Mine 47
4.2 Geological time Sarcheshmeh Copper Mine 47
4.3 Geological time warp of Sarcheshmeh Copper Mine................................. 48
4.4 Rock ore deposits geological origins 49
4.5 Familiar with the amount of stored Sarcheshmeh Copper Mine 50
4.6 General characteristics of the Sarcheshmeh Copper Mine.......................... 50
4.7 The Sarcheshmeh Copper Mine Development Project 51
4.7.1 Loading 51
4.7.2 Factors in determining the location of the mine crusher system............ 51
4.7.2.1 Time to prepare the site crusher and track bar 52
4.7.2.2 Mine capacity 52
4.7.2.3 The deposit of natural... 52
4.7.2.4 Distance.. 53
4.7.2.5 Blast 53
4.7.2.6 Safety.. 53
4.7.2.7 Appropriate space to establish Crusher.. 54
4.7.2.8 Economic factor 54
4.7.2.9 Transportation 54
4.7.2.10 Position relative to different locations mine crusher...................... 55
4.7.2.11 Staffing.. 55
4.7.2.12 No inconvenience to other machines 55
4.7.2.13 Maintenance bar during mining 55
4.7.2.14 consistent and compatible with mine development 55
4.7.2.15 supply route... 56
4.7.2.16 water waste.. 56
4.7.2.17 noise and dust.. 56
4.7.2.18 environmental impact.. 56
4.7.2.19 Geotechnical.. 56
4.7.2.20 roads and ramps... 57
4.7.2.21 topography of the pit and the bar 57
4.8 The benefits of this approach are: 58
4.8.1 The disadvantages of this method are as follows:................................. 58

4.8.2 The disadvantages of this method are as follows: 58
4.8.3 Advantages of this method include: 59
4.8.4 Disadvantages of this method include: 59
4.9 Determine the mineral crusher site 60
4.9.1 Determined according to the methods of mining crusher sites 61
4.10 Locations -finding stone crusher inside the pit in Sarcheshmeh Copper Mine 63
4.10.1 Locate the stone crusher inside the pit technique TOPSIS for waste 63
4.10.2 Converts indexes of quality indicators slightly 64
4.10.3 Making decision matrix 64
4.10.4 No scale matrix 65
4.10.5 Locate the stone crusher inside the pit technique TOPSIS for mineral 65
4.10.6 Locate the stone crusher inside the pit technique AHP for waste 65
4.10.6.1 The hierarchical graph 65
4.10.6.2 Calculate the weight of the elements in the Analytic Hierarchy Process 66
4.10.7 Locate the stone crusher inside the pit technique AHP for mineral 66
4.10.7.1 The hierarchical graph 66
5 CONCLUSION 67
REFERENCES 71
APPENDICES 74
RESUME 86

LIST OF TABLES

Page

Table 3.1: multi-criteria decision-making methods for locating the plant................ 24
Table 3.2: Vvariety of multi-criteria decision-making methods (Atagi, M.)............ 27
Table 3.3: Allocating points to the importance of standards. 35
Table 3.4: random inconsistency index.. 42
Table 4.1: the amount of classified and stored in Sarcheshmeh copper mine. 50
Table 5.1: finding dump site with TOPSIS.. 68
Table 5.2: finding mineral site with TOPSIS... 68
Table 5.3: for dump site with AHP 69
Table 5.4: for stone crusher with AHP... 69
Table A.1: Effective selection criteria factory for different people 74
Table A.2: Expression of qualitative positive indicator for a little bit...................... 77
Table A.3: Expression negative indicator for a little quality 77
Table A.4: Expression of positive and negative factors and the effect of the weight of each parameter 77
Table A.5: Scoring parameters for evaluation in different parts of the Sarcheshmeh Copper Mine Tailings.. 78
Table A.6: Decision matrix for dump site TOPSIS 79
Table A.7: No-Scale decision matrix for dump site TOPSIS 79
Table A.8: Build weight matrix 79
Table A.9: IDEAL and NON-IDEAL... 79
Table A.10: Scoring parameters for evaluation of minerals in different parts of the mine... 80
Table A.11: Decision matrix for Ore site TOPSIS.. 81
Table A.12: No-Scale Decision matrix Ore site TOPSIS 81
Table A.13: Build weight matrix 81
Table A.14: IDEAL and NON-IDEAL... 81
Table A.15: Inventory assigned numerical scores for each of the following criteria for the formation of pair-wise comparison matrix between standards.... 83
Table A.16: the importance of each of the following criteria 84
Table A.15: Calculation of AHP for stone crusher 85

LIST OF FIGURES

Page

Figure 1.1: Flowchart of how to organize the project in different seasons. 3
Figure 3.1: multi-criteria decision-making procedures (Hodgett, 2013) 23
Figure 3.2: building simple hierarchy 28
Figure 3.3: Features Analytical Hierarchy Process 31
Figure 3.4: Analytic Hierarchy Process(Burge, 2011)... 32
Figure 3.5: Hierarchy Chart 32
Figure 3.6: Hierarchy Chart with sub... 33
Figure 4.1: Facade of Sarcheshmeh Copper Mine 48
Figure 4.2: Division Sarcheshmeh copper mine in the mineral and waste discharge based on the location of the four areas. 63
Figure A.1: Ideal method steps 76
Figure A.2: Locate a hierarchical graph rock crusher in Sarcheshmeh Copper Mine Tailings.. 82

TAŞ KIRICI VE ATIKLARIN TOPRAK ÇÖKMESİNİ ENGELLEMEK. YER SEÇİMİ VE ÇALIŞMA KARARINI VERMEK İÇİN:AHP-TOPSIS METODOLOJİSİNİN UYGULANMASI

ÖZET

Bu Tezde, Sarcheshmeh bakır madeninde yeni taş öğütüncünün tahmini ile uğraşmak için bir yaklaşım önerilmektedir In pit kırıcıların en önemli özelliği. ekstaraksiyon masraflarını azaltmaktır .

Bu nedenle taşıma, kamyon ve kamyon sayısının işletme maliyetinin en az olduğu bir yerde bulunmansı gerekir.

Çeşiti pozisyonların diğerlerinende daha iyi olması va saha seçim alanının faktörlerinin bir yönde olmaması müktüdür ,Çünkü In pit kırıcıların muhtemel yerlerinin organize ve kapsamlı incelemesi gerekiyor .

Bu projede, Sarcheshmeh bakır madeninide atik kayaçların önemi ve duyarlılığı cevherlerden daha az ancak büyüklük dağılımı ve yük ve taşıma yeteneği en önemli değişkenlendir. Dört temel teknik faktör

Grubu ,ana faktör, çalışma faktörleri ve çeversel faktörler. In pit kırma yerinde seçim parametrelerini etkileyen parametreleri içerir

Kırma alanının sıralamasında batı davasında birinci sırada 0702 puan Güney duruma 0613 ile ikinci sıra

Doğu davasında 0508 puan doğu dördüncü puanı 0383 puandan üçüncü sırda yer aldı

Anahtar Kelimeler: *Taşkırıcı Çok kriterli karar verme MCDM*

AN APPLICATION OF AHP-TOPSIS METHODOLOGY FOR DECISION MAKING: LOCATION SELECTION FOR STONE CRUSHER AND LANFILL OF WASTES AS A CASESTUDY

ABSTRACT

In this paper offers an approach for dealing with prediction of the new stone crusher in Sarcheshmeh copper mine.

The most important property of In- pit crusher is reducing the extraction costs. So it must be situated in a place that operating costs of conveyor, trucks and the number of trucks be at least. It is possible the various positions be better than others and the factors of site selection choice are not in a direction, because the organized and comprehensive study of possible places of In-pit crusher is necessary. In this Project, multi-criteria decision method is used for ranking of waste in-pit crusher site selection in Sarcheshmeh copper mine. The importance and sensitivity of waste rock is less than ores but size distribution and the ability of load and transport are the most important variables The main criteria in four main groups of technical factors, costing factors, operating factors and environmental factors. Affecting parameters on In-pit crushing site selection choice include.

. In ranking of crusher site selection, the west case by 0.702 score in first rank, the south case by 0.613 as second rank, east case as third by 0.508 score and the east as fourth rank by 0.383 score was suggested.

Key words: *Stone crusher, multi-criteria decision making (MCDM);*

1 INTRODUCTION

1.1 The choice of subject

Quarried stone bearing that includes all processes to bring the Frontal rocks to the factory, storage of materials or dumping of waste are mining activities that have been considered in this study.

In many open pit mines in the world, the first method for mining is open extraction method because it makes multiple steps inside the ground. After drilling and blasting to portable size is dumped into a truck. Trucks loading the materials into the truck box and trucks crossing the specific ramps in brae of pit and steps carry the materials to stone crusher, High-grade ore storage or dumping of waste in the pit carrying out addressing. With deep in the Earth are carried forward to the extent that other extraction processes are not economically. So we should be looking for ways to solve this problem. Now days, stone crusher and conveyor system are utilized, and in this study it was discussed in detail in terms of technical and economic point of view.

Sarcheshmeh Copper Mine, the largest open pit mines are considered the world. Due to the high volume production of minerals and tailings away from the loading and unloading of the review on the application of the system to improve the mining is necessary. If during the extraction current method, after multiple investigations, Use the crusher and conveyors within more suitable pit and pit depth to the extent or in the future is that the open method is not enough anymore. Also, due to the geographical location of the mine, In the winter, the conditions for freight operations muddy and icy and snowy roads is difficult and the system is a good option for faced with this problem is to consider more seriously affect the implementation of the system in the mine.

1.2 The importance and necessity of research

According to the records of the system of stone crusher and conveyor belts inside the pit mines in the world`s great and desirable results an increasing the depth of the pit mine originates in the development plan and increasing the costs and the problems with the current method, the studies done in this area for this mine is necessary and urgent.

1.3 The Territory of the obligatory study

This study was conducted in the sarcheshmeh copper complex, located in the province of Kerman sarcheshmeh copper mines, one of the most-molybdenum porphyry at the level of the world. This mine in 160 km from the South West of Kerman and 50 km from the South West and in Rafsanjan, parizaz momraz strap heights set the functions of the city and in longitude East and 55 º 53 ' to 29 ' latitude North and 58 º and at a height of 2600 meters of sea level, actually.

1.4 Hypotheses

The study is based on topographic maps and production schedule are available at Sarcheshmeh copper mine development project. Design and application of the map according based on selections, 5, 10, 15 and 20 years mine development. It is assumed that in the future, also, production planning and advance on the basis of this development plan.

1.5 Thesis structure

The present study consists of five chapters:

- First chapter: In this section, we discuss the introduction to the expression and determine the necessity and research objectives will be discussed.
- Second chapter: Literature review
- Third chapter: Expression of Multiple Criteria Decision Making and scientific history of multi-criteria decision finding space for industrial and mining projects will be introduced.

- Fourth chapter: The introduction of Sarcheshmeh Copper Mine, reviews of the crusher and crusher inside the pit layout position using multi-criteria decision will be studied.
- Fifth chapter: Conclusions, suggestions and feature study.

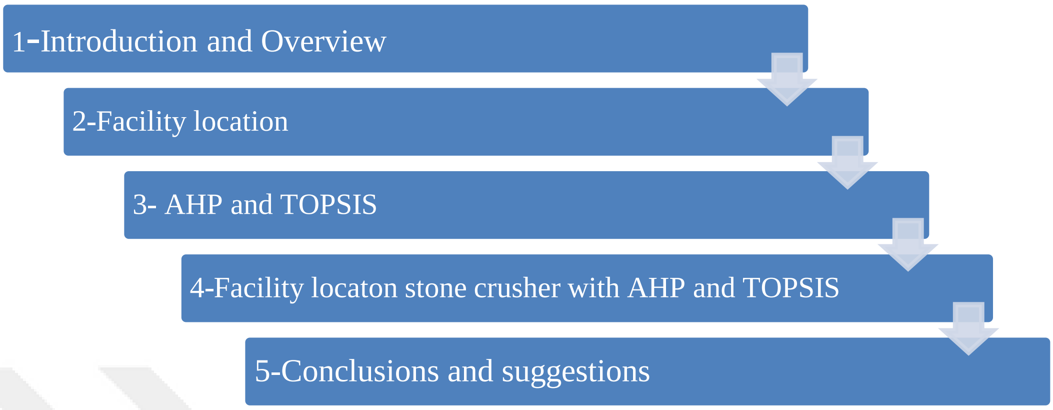

Figure 1.1: Flowchart of how to organize the project in different seasons.

2 LİTERATURE REVİEW

2.1 Introduction

Evaluation and selection of site for construction of the plant in a manner that respects technically feasible and economically affordable ways is absolutely necessary and inevitable. The choice of location is an ideal plant so that it may be due to the limitations of all aspects of the right is not possible; therefore, it should be possible to select the most appropriate location. Today, the increasing development of science and increase the volume of information and identify new sources, is no secret. In recent decades, environmental, political, economic, social and cultural, in the creation of new places and diversify the places and culture, has left deep effects. In such an environment where users are required to use appropriate methods and tools can no longer focused on traditional tools and methods. Location decision is a major issue for planning new development, specially within the planning of new healthcare infrastructure(Dehe and Bamford, 2015),(Fazeli and Osanloo, 2014) According to the study on locating the plant from various aspects such as market and technical and financial aspects are important, there are many factors that are in place for effective decision making. The industry needs to select the optimum location of each unit to identify effective measures in this regard to the facilities and capabilities of different areas. In countries that are faced with limited resources, Determination and identification of these criteria is more important. Therefore, the decision criteria defined in this chapter and effective criteria for choosing the appropriate plants are discussed.

2.2 Decision-making criteria

The theme of purpose and constructive criteria that decision makers would consider to enhance their utility and satisfaction, it is said that criteria. In fact, the touchstone of objective criteria or by measuring it. In other words, the criteria, Standards and laws that have been used to judge the effectiveness of the decision-making suggest. The standard size components aim to cover more and more expressing the target, the possibility of getting more accurate results will be increased. The criteria may be quantitative, and can be expressed in the form of numbers. The various mathematical methods to solve them. But if the criteria are qualitative, the other cannot be easily used mathematical and quantitative methods and their specific needs. In these cases, the need for a standard qualitative index.

Many issues can be seen in the decision-making criteria, both quantitative and qualitative, which in some cases also do not have one, so in dealing with these issues should be looking for an option with the most advantages for the relevant criteria. MCDA is recognized as the right approach for location or supplier selection when both qualitative and quantitative factors are considered(Ram, Montibeller and Morton, 2011),(Golmohammadi and Mellat-Parast, 2012),(Ho, Xu and Dey, 2010),Multi criteria decision analysis s (MCDA) examine and compare two modeling methods to decide about health care infrastructure location decision. Evidential Reasoning (ER) was used to solve the model and then the AHP was used to compare the results(Dehe and Bamford, 2015).

2.3 Effective selection criteria Factory

Select the location of various industrial units or mining, depend on many factors that are directly related to the results of plant design and partly dependent on environmental factors or economic. The most important criteria in the selection of the plant site include:

annual consumption of raw materials which supply the plant and its location, close enough to the sources of raw materials, enough amount of raw materials at location, Degree confidence access Substance Primary, amount Desirable to be materials primary available at location. The possibility of using from products subsidiary units' industrial indeed at region the subject a matter Primary. The skilled human resources, energy, sale market, network transportation, Rules and regulation Government, Transportation of raw materials and production. Ancillary and support spaces needed by industrial sectors, removal of waste and residues manufacturing industry, providing suitable land, markets, consumer goods and manufacturing, the factories weather conditions, amount of water and the supply and transmission of electricity consumption. Manufacturing and distributing the fuel consumption values Manufacturing and distributing them the amount of flexibility in relation to changes in plant type. Quality and price materials Primary, how to prepare building materials factory buildings, seismicity and ground situation in terms of earthquake faults. Settlement centers providing human resources and environmental factors such as the social, environmental and so on.

In recent years, various articles about the research and production sites in prestigious journals inside and outside have been published. Different people have different criteria for selecting the factory considered that its abstract presented in appendix ***Table A -1***.

2.4 Market

Distance from the factory to the sales market is important. This is on the factories to produce goods they are heavy and bulky and factories that should have a stronger relationship with the customer is of greater importance. For example, when a factory goods produced according to customer order is created and the need for communication between factories and customers, presence at the customer site and direct contact is very important.

2.4.1 Raw materials

Quick and easy access to raw materials, parts and tools is also an important factor in determining the location of the plant. Generally, when transportation costs, constitute a significant percentage of the cost, this factor becomes more important. On the other hand, some raw materials due to physical characteristics or other reasons not easily portable. If these materials form the greater part of the required resources, plant construction site near to the production of these materials should be considered. This is the raw material of agricultural products or livestock factories that Foss is doable and it is true, as industries such as milk, canned and conserves building. Also, in the case of the raw materials, low-value bulk minerals such as cement and lime situation is so.

Information from the raw materials during the construction of the plant should be evaluated to determine the position includes:

- Quantity and quality of raw materials
- The cost of extraction
- Time and place of preparation of materials transported easily to the factory
- The amount of storage
- The probability of new material instead of the previous material

  We figure out the table A.1 about effective selection criteria factory for different people in appendix

2.4.2 Work force

The amount, composition and quality of the labor force as one of the important elements for locating the plant in the current era has become more important. To determine the area should be availability of labor, specialization and skills needed and the common wages in the region noted. Due to differences in socioeconomic status between the different regions of the country and backwardness of some of them, may be less willing professionals with a desire to work in this area. So in this regard, provided the conditions necessary to attract experts. The intelligence of human resources in times of plant location must be assessed, including.

- The combination of age
- The degree of specialization
- The type of business or fan
- Standard of living and wages
- History and Labor Relations
- Stamina and endurance workers and the degree of their efficiency
- The supply of
- Educational facilities available in the desired location

2.4.3 Rules and Regulations

Different regions of the country such as provinces and cities can help to attract investments and create incentives, regulations and laws have specific and thus more rational and equitable geographical distribution of incentives for investment and smoother. For example, more favorable conditions and low interest credit or low taxes and possibly including tax exemptions could be ordained.

Mining and related industries are also can effecting on environment so managing of transporting and find the best way to bring them to process line of heavy metals and acid mine drainage generation are very important(Ebrahimabadi and Alavi, 2013). The environmental can be define like as public health and safety, social relationships, air and water quality and some various impacting factors from mining activities were estimated for environmental component(Monjezi *et al.*, 2009).

Some areas due to the accumulation of various industries, crowding and pollution can be prohibitive regulations and laws. Regulations relating to environmental pollution could be like this. Sometimes the rule of law, the establishment of some plants is banned in certain areas. Therefore, on locating the plant are also to be considered. Some of these rules and regulations sharp words from.

- Labor regulations
- Industry Regulation
- Tax regulations

2.4.4 Fuel

The existence of the required fuel in the area and move it on the selection effect of factory construction. Sometimes there are proper and cheap fuel because of the areas forbidden by such natural gas has privileges.

2.4.5 Power

There is sometimes a major factor in locating the power plant, for electricity transmission to distant locations at high cost and cost-effective only for the construction of a factory may not be justified. Sometimes it is high in industries such as electrochemical power consumption; the limitations in terms of site selection have not created.

2.4.6 Water

In almost all industries, water is one of the resources required and inevitable. Water can be a limiting factor for the growth of industry in some areas. The effects of water in the factory on the type of plan are to what extent and how well needs water. Provision of adequate water quality and the condition of the first to implement many of the industrial design, especially for some fields, such as chemical industry, smelting, paper, leather, etc. The major consumer of water. Water quality for the factory to a number of factors such as the degree of difficulty, but its composition is concerned. Demand for high-quality water in the plant is not uniform and depends on the type of water use in the factory. Water quality is most important in fields such as food and pharmaceutical industries high water in the fields of raw materials and even minor feature of the product is considered, therefore, no doubt that water affects the quality of the product. In light of the above it is clear that the location of the plant to the water issue should be considered as an effective factor.

The exploration and study of water and then requires much work and investment is substantial and key issue to be raised. For example, mining and non-residential usually done in desert areas and in these cases the plant so that the water issue in the drilling of water from the most remote corners is also very important.

2.4.7 Transportation

There are facilities of transportation such as rail, road and air and sea transport facilities for labor mobility and transport of raw materials and equipment manufacturing plant and transmission and distribution of products, the decision to locate the plant plays an important role(Chakraborty, Ray and Dan, 2013). However, with the development of transportation facilities, the importance of this factor has been reduced, but still one of the main criteria is the location of industrial design. The purpose of this factor, reducing the time and cost of transport(Celik, Erdogan and Gumus, 2016),(Zak and Węgliński, 2014). For locating the plant in terms of transportation, abundant raw materials and products manufactured and shipped them into consideration is the distance. In the field of industrial raw materials index due to the heavy or bulky, high place of the factory should be closer to sources of raw materials and if the subject is reversed and the production of such product, the factory should sales taking place close. In some branches of industry, the main criterion for determining the location of the factory is the transport issue.

What about transportation should be considered in the following:

- The amount of transport needed for labor, raw materials, equipment and products
- Existing transport facilities including railway, road, sea and air routes
- Access status of public transportation
- Rate and transportation costs

2.4.8 Weather conditions and local

Some plans are sometimes due to the characteristics that should be in place that have particular climatic conditions, occur in this equation is that uses solar energy or the plans are and plans for the wind energy agriculture covered by the Climatic factors, climatic and local conditions that may be considered in the plan include:

- The air temperature
- Humidity
- The sun
- wind blow
- Rain and snow
- Dust and smoke
- flood
- Earthquake

2.4.9 living conditions

In the case of plants that create possibilities for their life is unpredictable, locating the plant where such option, or close to it, the point is significant. Among the possibilities cited as follows:

- Housing
- School

- hospital
- Facilities Order
- Welfare

2.4.10 Earth

On locating the plant, the land that is suitable ways, it is important:

- Land area
- Earth location
- Technical conditions such as earth resistance
- The price of land

2.4.11 Industrial history of the location

Items may be some industries in certain regions or areas of carpet weaving in Kashan focus is more, for example, industry or food industry in Mashhad named.

The concentration can have advantages as follows:

- Workers and industry professionals relevant
- There are services and services for industry
- State and municipal organizations familiarity with industry regulations and their previous issues

2.5 Effective criteria for selecting a processing plant

The criteria for the processing plant divided as follows:

a) Environmental and geological criteria

- topography
- Soil erosion and stratigraphic
- Hydrology and hydrogeology
- air pollution
- Noise
- Solid waste and materials
- Tectonics and seismicity of the region
- The constituent layers of the ground material

- Structural Geology
- Climatic conditions (weather):
    - Rainfall
    - Evaporation
    - wind blow
- Ecological value of various plant species

b) Setting standards of social, economic and cultural

- Social environment
- Economic environment
- Cultural environment

c) Economic criteria

- Land ownership
- Access to facilities, electricity, water and sewer systems (water supply, electricity supply, gas supply)
- Transportation
    - **Environmental and geological criteria**

    Topography: plant and related facilities due to land clearing, excavation in very high volume, waste production, operation of the plant and its related sectors such as bar feeders, conveyors, mills, transformers and electricity for water pumping and aeration pumps can partly change the topography of the area. Therefore, before construction of a plant should be investigated its impact on the topography of the area.

    - **Soil erosion and stratigraphy:** the impact of the plant on the stratigraphy should be monitored because of the leveling, soil formation changes. Processing plant construction work including leveling and digging the foundation and the movement of heavy machinery causing soil erosion and natural erosion by up to 500-fold increase these areas and landslides and subsidence soils around the area, will have a direct impact. That by taking this parameter can be consequences at the local plant and soil erosion. It is important to be prevented.

- **Hydrology and hydrogeology**: Surface water and groundwater play an important role in the location of the factory. One of the most important goals is mapping not prevent the entry of contaminants into the water. In most cases, penetration and water flow and contaminant transport is the main factor mobility.
- **Air pollution**: construction work processing plant that sometimes it may take up to 3 or 4 years, during this time will be different excavation and transportation equipment also adds to air pollution. While factory activity in the various sources of air pollution, including dust and pollution from fuel. During the process of burning natural gas and particulate matter So 2 And No X and Co The air that should not be outside the standard mode. In addition to the impact on human health and the impact it will have its effect on vegetation, soil moisture and wind erosion is a small investigated.
- **Noise pollution during** construction of processing plant operations, including excavation, concrete and equipment will be installed to transport heavy machinery such as loaders, dozers and trucks will follow. If possible, place the plant must be the right distance from residential areas. As well as its impact on the life of the various animal species studied.
- **Solid waste and materials:** materials processing plant in several directions may be thrown out of the line. In the mill, the milled material in the pouring conveyor, the material on the conveyor path, around the separator, the mud-water discharge channels, all of these materials can be directed to landfill waste impact on the environment leave. In addition, all non-monetary value of goal-water plant and the waste of capital. So it should be installed within the walls or roof of the conveyor belt, and so it is trying tails.
- **Tectonics and Regional seismicity should** also review the impact of the plant on seismicity zone on the tectonic well as

additional studies need to be done. Geological study to select the best rock with low permeability is directly controls every area of bedrock geology and soil type which it is created. Soil loading capacity after the plant also depends on geology. Geological structures such as the joints, faults, anticline and syncline are very important role in the selection of the factory.

- **Layers forming the earth:** gender units on the basis of their permeability are important. Each unit is higher permeability allowing leakage of waste water from the factory to a lower energy level and increases the risk of groundwater contamination. The comparison shows that the rate of permeability of rock crystal stones without seams a little fluid to pass through it, while weak cemented sandstone fluids more quickly than among their particle transmission. Due to the high permeability sandstone rate than other types of sedimentary rocks including limestone and shale, sandstone bedrock factory as inappropriate. Calcareous rocks are not suitable due to its high solubility.
- **Geology**: In addition to gender and permeability geologic units under construction area is also an important factor in the selection of suitable plant location. Among these conditions can be faults, joints and cracks anticline and syncline and noted.

d) Setting criteria for social, economic and cultural

Construction of the processing plant with a number of skilled and low skilled labor technicians will be employed. Multitude of active, educated and expert area is increased. Plant personnel and payroll expenses directly and indirectly affect the economic situation. Access routes and construction of ancillary equipment to improve facilities within the immediate and direct community can effectively. Factory can have a positive effect on the region's culture and tourism of Highly Effective People will be improved and enhanced.

- **Social environment:** people and officials in the region to factory condition for good economic performance should make the city and area. In addition to feeling good about the social effects of different professionals in the region with the frequency of various activities within the plant construction period will be working. Staff at this period of his career. These are all related specialties population only increases the literacy rate in the region and the construction of factory activity level may cause the majority of youth villages in search of work and gone to other cities have returned to the area. In addition to the social foundation of the region's positive migration with full native people living with elderly parents is strong.

Economic environment: To be sure, the cost of building the plant, staff salaries, cost of living, spare parts, construction materials. . . The cash flow and the impact on the local economy will plant in the region. Increases the value of land in the region. Access roads to the plant, water piping, electricity and infrastructure services to the creation of direct and indirect economic conditions and the immediate area affected residents will be directly affected. People expert in the area of employment and wages are relatively high will be paid. As a result of the circulation of money and high service value and price will find it’s true. In this way, the money circulating in the population and provide access to all facilities including food, housing, etc. will be easy.

e) Economic criteria

- **Access to facilities, electricity, water and sewage system:** In place of the factory site for the welfare of employees and facilitate the operation, the access to electricity, water and sewage systems became practical.
- **Transport:** Considering the relatively high volume of incoming materials to the factory, transportation of these materials is certainly one of the most important issues for choosing the factories. Also consider the distance, the amount of cargo that is shipped must also be considered. In general, for ease of transport and relocate the plant and reduce the time you have to use the

main road and the road and to the existing close. Also, you should note that the road in terms of width and width for passing cars Heavy appropriate.

- **Land ownership:** Due to the large size of ground to plant the required range of economically important plant. Appropriate public ownership of private property, as in the case of private property, the owner problems in relation to cost the earth was formed out. Sometimes you may need to confirm that the expropriation in this case the delay in the manufacturing process can be. Preferably on the site of the factory land with low price shall be used.

2.5.1 Effective criteria for site selection plant at the mine processing

After this initial evaluation of underlying factors that influenced the choice of plant location, such as the existence of appropriate size and morphology factory, the possibility of acquiring the land and the right distance from its morphology suitable for waste disposal, Possibility of water and electricity supply, access to major roads are became clear that the region has the potential construction of a processing plant.

- **Near to mine:** This parameter is important in this respect is closer to mine additional costs to reduce the displacement of people and the distance between the facility and the reduced administrative and supervisory affairs is easily done. The use of existing facilities at the mine will reduce a lot of costs. Anything that is closer to mine better.
- **Distance to the railway:** Freight rail is possible to use the processed material if the distance is less being better and its reducing cost of transportation.
- **Distance to the tailings dam:** waste transfer processing for the most part that waste pipe used to transport the slurry to the tailings dam. So whatever the distance is less than the cost of pipe-laying and leveling path of reduced, the location of the processing plant

should be selected somewhere near it is possible to create a tailings dam.

- **Proximity to water sources:** Due to the high consumption of water plant to supply water to the distance to water sources is less than the cost of water supply.
- **Distance to the power station:** distance to the substation to supply electric power plant less is better and the cost of electricity is reduced.
- **Suitable slope for pumping waste to dump:** To move tailings from the mill to the tailings dam, which often takes the form of slurry? The factory should be in a higher level of tailing dam and the slope is greater than the cost of pumping the waste is reduced.
- **Close to the main road of mine:** The distance from the main road is less than the cost of building the access road meters and length of secondary roads is reduced.
- **The excavation for leveling the ground:** The amount and volume of excavation for leveling the ground is very important, so the location of the flat topography have reduced cost.
- **Conveyor length (the distance from the crusher):** For less than the cost of transporting materials from the crusher plant is the less the better and if the conveyor is used as the shorter route along the conveyor belt conveyor maintenance costs are reduced.

2.6 Location

2.6.1 Concept of location

Overall allocation means finding a suitable place for mounting machine or factory is in such a:

- Convenient access to needed resources (for example raw materials)
- Not create problems for the environment (compliance with safety regulations, etc.)
- The transport even less possible connection may be possible.

- Consumer access resources easily are done.
- The need for machine or plant even be met in the environment is possible.
- Remove or reduce the effect of the cost parameters.

2.7 Location levels

Placement in various sizes so that the establishment of a switch on the establishment of a particular industry in a country Operated included. In other words, small-scale placement by selecting the appropriate location for one or more large-scale linked with the issue of land use. The plan land use in the area of the country's overall exposure to rational disciplines of industry in space, Balanced, proportionate and balanced growth of the various provinces of the country with full use of natural resources in order to obtain maximum efficiency.

2.8 importance of location

How to locate the facility a major impact on the success of capital investment undertaken? In general, a car factory or establishment enormous Doberman is not something that after a while it stopped and moved to another place, not least the factories that because of construction in the wrong place can cause problems for themselves and

Or citizens that ultimately led to the closure or closing it. Problems such as lack of access to raw materials, markets, lack of enough land for development, the cost of exorbitant transport and failure to comply with environmental and other issues.

2.9 Diversity issues of location

Placement issues can be categorized as follows:

- The number by which you must be finding:
- Single (individual) b) multiple or compound
- The number of locations candidate:

- Few and limited points can be replaced by (suites) are new.
- Unlimited: This included the full screen and if placed on the instrument prior to re-dissolve. (Continuous placement)
- In terms of the number of effective parameters:
- Single parameter (for example distance traveled) b) multi-parametric
- The presence of current devices:
- The relationship between the new devices:
- Relationship with each other
- Failure to communicate with each other
- In terms of distance:
- Rectilinear (orthogonal)
- Straight Line Distance

2.9.1 Method for solving problems placement

Responsible for placement or qualitative or quantitative methods of solving some of the methods include:

- Facility location with individual scoring
- Single-Location
- Multi-facility Location
- Assignment Model
- Geographic Information System

2.10 Methods of site selection plant

The process of selecting the best location or choice of locations or options often difficult. In order to determine the best location to build a factory various methods have been disclosed. That may be the way too generally to five divided into the following groups classified:

- Multi-criteria decision-making methods
- Fuzzy MCDM methods
- Geographical Information System (GIS)
- The combination of multiple criteria decision making GIS

- Select models of the plant

The equipment for mining and engineering judgment have a lot of effect for select the new stone crusher in open-pit types of mine that the present work explores with TOPSIS and AHP method(Rahimdel and Karamoozian, 2014). There are a lot of alternatives and criteria's for defining mining land in other hand multi criteria decision making MCDM methods can be useful(Bangian *et al.*, 2012). Geographical information system GIS is one of the most comprehensive and most capable systems that serve various disciplines including management science and industrial sites are selected(Graham *et al.*, 2011)(Panichelli and Gnansounou, 2008). GIS suitability analysis can be applied for siting facilities such as healthcare, clinic, power plant, transportation stations, bioenergy location, retail site and etc.(Beheshtifar and Alimoahmmadi, 2015),(García-Palomares, Gutiérrez and Latorre, 2012),(Suárez-Vega, Santos-Peñate and Dorta-González, 2012).

3 METHODOLOGY: MCDM

3.1 Introduction

Today, the increasing development of science and increase the volume of information and identify new sources, is not a secret. In recent decades, environmental, political, economic, social and cultural, in the creation of new places and diversify the places and culture, has left deep effects. In such an environment where users are required to use appropriate methods and tools, can`t be insisted upon traditional tools and methods. In other words, the methods can analyze the geographical phenomenon is not new, and requires the use of integrated and analytical. GIS is one of the most comprehensive and most capable systems that serve various disciplines including management science and industrial sites are selected. The system can be in the collection, storage, analysis and output jumps it suitable for different plans for the Bulls. On the other hand, traditional trade issues, often with one goal and that maximizing profits were explained, but today this figure could pave the way for progress in the trade. Multiple and conflicting objectives such as minimizing cost and maximizing service quality, true art today's decision makers. These issues are much more complex than traditional past issues. We always compare our goals with multiple criteria and ranked them. These issues dramatically in recent decades have been considered.

Complexities Environmental planning, Intensity Information and Difficulties Numerous That in the world Modern with It Is facing Single logic and Rejects. It is hard to see from an angle around a one-dimensional phenomenon and deal with an indicator to judge. The inherent complexity of many environmental decisions in today's world, the need to store the wide view in the store, and the decisions of various people with jobs, expertise, experience, perspective and diverse scientific backgrounds, along with the use of a group decision making techniques, classic and fuzzy group is more necessary.

3.2 plant site selection methods

The process of selecting the best location or choice of locations or options often difficult. In order to determine the best location for the construction of a factory many methods have been proposed. There are a lot of alternatives and criteria's for defining mining land in other hand multi criteria decision making MCDM methods can be useful(Bangian *et al.*, 2012). MCDA is recognized as the right approach for location or supplier selection when both qualitative and quantitative factors are considered(Ram, Montibeller and Morton, 2011),(Golmohammadi and Mellat-Parast, 2012). There are many techniques available for solving MCDA problem(Liao and Xu, 2013),(Wang, Zhu and Wang, 2016).

The methods which can be generally divided into five groups:

1. Multi-criteria decision-making methods

2. Fuzzy MCDM methods

3. GIS

4. The combination of multiple criteria decision making GIS

5. Select models of the plant

3.2.1 Methods MCDM

Science decision-making is one of the areas that are growing quickly. That is the important branch of science decision making area. Multi-criteria decision-making on issues that can be decided by several criteria and standards are usually incompatible with each other, face or in other words decision Conclusion Several Criteria, Selection Option Premier with at Opinion to have several Criteria. These criteria can be qualitative or quantitative, positive or negative. Multi-criteria decision-making problems with standard n and m option, often expressed by the matrix

$$R = \begin{array}{c c} & \begin{array}{cccc} c_1 & c_2 & \cdots & c_n \end{array} \\ \begin{array}{c} A_1 \\ A_2 \\ \vdots \\ A_m \end{array} & \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{12} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \end{array} \qquad (3\text{-}1)$$

Aj Is available option and Cj are decision criteria.

The relative importance of the criteria expressed by the normal vector W.

$$W = [w_1 \; w_2 \; \cdots \; w_n] \qquad (3\text{-}2)$$

Multi-criteria decision problems are widespread and diverse. Many methods have been proposed.

And the factory has been applied in various articles (Table 3-1). The following are the most important methods are mentioned. But the general principles are all multi-criteria decision methods in the order shown in Figure 3-1.

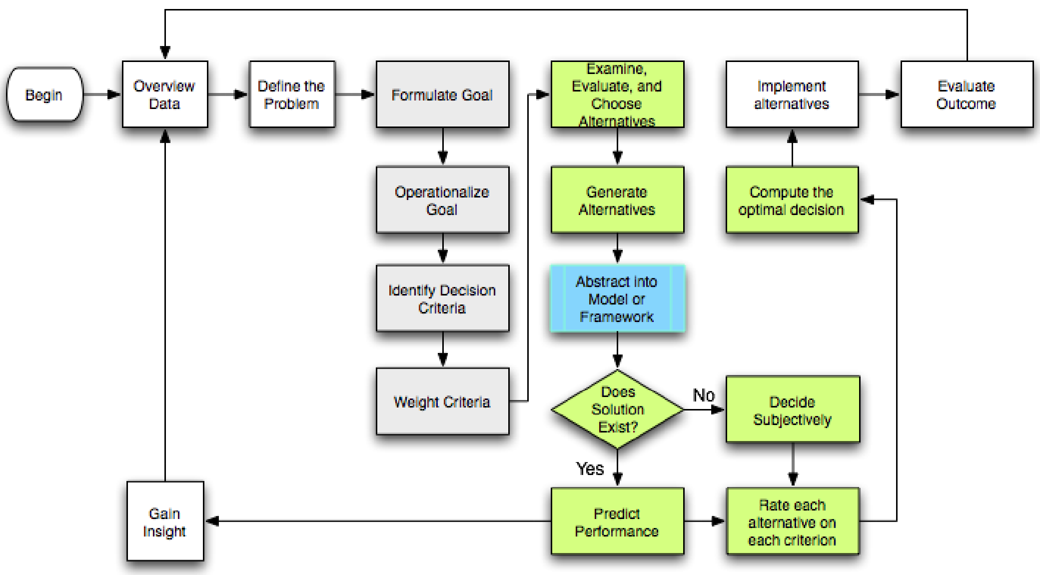

Figure 3.1: multi-criteria decision-making procedures (Hodgett, 2013)

3.2.2 Division multiple criteria decision making problems

Multi-criteria decision making problems into two general categories: multi-objective models and multi-attribute model Divided:

- multi-objective decision making (MODM)
- Multiple Attribute Decision Making (MADM)

Table 3.1: multi-criteria decision-making methods for locating the plant

Research	Authors
A Framework for Multi-Criteria Decision Analysis with AHP	Yatsalo, B. Didenko, V(Yatsalo *et al.*, 2015)
The selection of the logistics center location based on MCDM/A methodology with TOPSIS	Zak, Jacek. Węgliński, Szymon (Zak and Węgliński, 2014)
A multi criteria intuitionistic fuzzy group decision making for plant location selection with ELECTRE method	Devi, Kavita, Yadav, Shiv Prasad (Devi and Yadav, 2013)
Multi criteria decision making methods for location selection of distribution centers	Chakraborty, Romita Ray, Ankita Dan, Pranab K (Chakraborty, Ray and Dan, 2013)
Evaluation of suitable locations for the installation of solar thermoelectric power plants	Sánchez-Lozano, J. M. García-Cascales, M. S. Lamata, M. T.(Sánchez-Lozano, García-Cascales and Lamata, 2015)
An integrated decision-making model for the location of a PV solar plant	Lee, Amy H I Kang, He Yau Lin, Chun Yu Shen, Kuan Chin (Lee *et al.*, 2015)

In practice issues that fall in the category of multi-criteria decision-making related to issues that lead to choose the best seller and multi-objective decision-making related to design issues are best at distinguishing Multiple Attribute Decision Making this is usually a few options that can be set before the start of the decision-making process. Design options and the number of criteria are considered; the final decision has an impact on health. And the final decision is based on comparisons of these options based on criteria, is done. Multi-criteria decision-making models and multi-objective differences in Table 3-2 are inserted.

- **Multi-objective decision problems**

Multi-objective decision problems a set of goals that cannot be simultaneously achieved all of them. This decision focuses entirely on practical space. And solved with mathematical programming techniques. Multi-objective decision-making generally with the aim of ranking decision-maker relationships between objectives and options, deal.

- **Problems Multiple Attribute Decision Making**

Multiple Attribute Decision Making matters with issues choose an option from a set of options that can be measured by the standards, are concerned. Multiple Attribute Decision Making is a qualitative approach. And require information on the criteria for setting priorities and prioritize the available options. Decision-making may, ranking the options by weighting or relative importance of the state. Multiple Attribute Decision Making express purpose of optimization options that have the highest degree of satisfaction criteria.

In multi-attribute decision making problems, both quantitative and qualitative criteria are expressed. In such matters each option and select a few characteristic is evaluated by determining the desired level criteria or through comparisons of test criteria and alternatives will be considered. Multiple Attribute Decision Making Can is summarized in a matrix. The columns represent the interest of the problem desired criteria and rows contain the list of options that we want to compare them. Especially a multi-attribute decision problem with *M* option (A_1, a_2... A_m) With *N* Criterion (C_1 , C_2 ... C_n) to be evaluated can be in the form of a geometric system M Point in space N The next show.

In these methods, qualitative indices become small numbers compared with each other and determine the importance and priority of each, the better option is selected. Interactive and non-interactive multi-criteria decision-making methods are divided into two categories. These types are listed in Table 3-3. The default non-interactive ways that each independent of the other criteria and each criterion in the selection are important in itself. These three categories of criteria no preference solving techniques, methods and approaches in solving the standard level of quality divided priorities. Interactive methods criterion strengths and weaknesses of other measures to cover the total weight of the criteria considered. Simple weighting method, a method similar to Ideal, methods of control implicit and interactive methods are the most important Analytic Hierarchy Process.

3.3 The analytic hierarchy process (AHP)

Analytic Hierarchy Process is one of the most powerful techniques multi-criteria decisions by the professor Saaty at the University of Pittsburgh in 1980 and, despite some criticism from the scientific community was welcomed. The method that reflects natural behavior and human thinking, decision makers enables the interaction between various factors in complex situations and unstructured offer. This technique, decision-making by organizing emotions, perceptions, estimates, judgments and facilitate effective decision specifies forces(Zhou, Zain and Mo, 2015),.

AHP is one of the most comprehensive systems designed for decision-making with multiple criteria because it is technically possible to formulate the problem as a hierarchy and provides qualitative and quantitative also possible to consider the criteria on the issue. The different options in the decision-making process and the possibility of a sensitivity analysis on its criteria. In addition, based on paired comparison, make it easier to judgments and calculations(Bozbura, Beskese and Kahraman, 2007),(Jakhar and Barua, 2013).

The degree of compatibility and incompatibility decision shows that the distinctive advantages of this technique are the Multi-Criteria Decision Making. In addition, a strong theoretical basis, and are based on the principles that continue to the end of such principles discussed. Analysis analytic hierarchy process with complicated issues, it has simply become to solve it pays. In fact, analytic hierarchy process to help decision-makers to targets and solutions in a complex environment unstructured and non-transparent, prioritize and categorize [3].

Table 3.2: Vvariety of multi-criteria decision-making methods (Atagi, M.)

Non-interactive methods	- No preference criteria solving techniques	• Dominance method • Maximin method • Minimax method
	- Solving techniques with standard level	• Conjunctive method • Disjunctive method • Emissive method
	- Solving techniques with qualitative preferences	• Lexie Graph • Semilexio Graphy • Priority method
Interactive methods	• Simple Additive Weighting method (SAW) • Compromise programing • VIKOR • TOPSIS • ELECTRE • AHP	

In this way, the decision to target levels, criteria and sub criteria and alternatives split decision maker can easily make any decision carefully. For model making decisions, in highest target level and the level or levels between the standards and possible options is set at a low level. The main research question or problem to be solved, said to be the target. The purpose of the chart is the highest level of the hierarchical and there is only one parameter to choose it is the duty of the highest decision of the project [3].

The underlying objective criteria and according to the manufacturer's standards. In fact, the touchstone of objective criteria or by measuring it. The standard size components aim to cover more and more an expression of the target will increase the likelihood of getting a more accurate result. Criteria are the second level of the hierarchy after the goal. At this level, can be traced by the necessity to regulate the number required in the horizontal plane. Criteria can be divided into sub-criteria and sub-criteria are next to the following criteria. This situation can vary depending on the necessity to n the benchmark in vertical and horizontal level rise [4].

In fact, the purpose and target destination options in response aim of the hierarchy are drawn from among the options is obtained. The last level of the hierarchy are options, depending on how you use is the Analytic Hierarchy Process. In cases where the technique is used to select or prioritize, generally carried out by the researcher to determine the options, because it is he who will determine which options should be among the options to prioritize, or. Building simple hierarchy shown in Figure 3-2 [4].

The most important feature is the ability to turn the Analytic Hierarchy Process hierarchical structure to structure a complex problem developed multi-attribute decision-makers to better understand the issue of decision-making. The method for determining the relative importance of the criteria or options on paired comparison (duplex) of decision taking into account the criteria or based options [3].

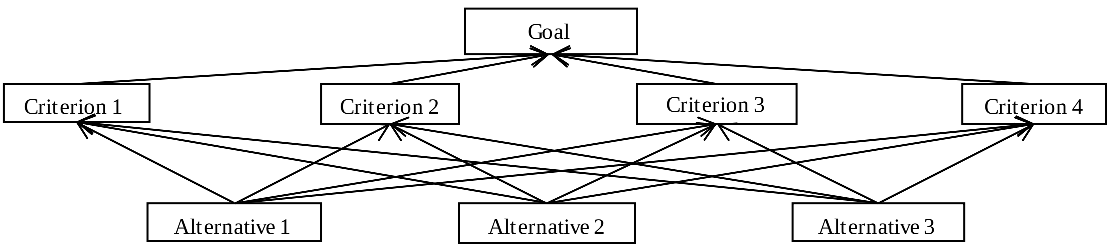

Figure 3.2: building simple hierarchy

Analytic Hierarchy Process is divided on the issue of decision-making that decision-makers of the smaller comparing to the effective factors in the decision leads to the importance of the criteria and the effectiveness of each of the criteria by the experts expressed in the hierarchy. The Rhine is based on subjective judgment, the importance of each criterion relative to other criteria, numerical values assigned. Finally, the criteria that are most important are specified. In other words, the order of priority of criteria to be determined. The overall rating for each possible option, multiplying the comparative advantage of each route option decision is obtained, and then the points will be added to each decision option.

Thomas Saaty (Founder of the method) the following four principles as principles of AHP stated and all the calculations, rules and regulations is founded on these principles. These principles include:

Theorem a) Reciprocal Condition: If A element would be found on the B element is equal to n, B on A element would be equal to 1/n.

Theorem b) Homogeneity: Ingredient A with ingredient B must be homogeneous and comparable. In other words, the element B A superior element cannot be infinite or zero.

Theorem c) Dependency: Each element of the hierarchical higher level element can be linearly dependent and this dependence could continue to have the highest level.

Theorem d) Expectations: Whenever a change occurs in the hierarchical structure, the evaluation process should be done again.

AHP for the first time designed by Saaty was one of the most comprehensive and efficient systems designed to solve problems of multi-attribute decision making (MADM) Is. This process:

- Ability to model the decision to issue provides a hierarchical structure.
- Considering the possibility of simultaneously providing quantitative and qualitative criteria.
- different options in the decision-making.
- 4. Paired Comparison based test that will facilitate judgment and calculation.
- show the compatibility or incompatibility of the decision.

3.3.1 Advantages of AHP

Analytic Hierarchy Process due to strong theoretical base, high accuracy, ease of use, having value and accuracy of the result, one of the most prestigious and most widely used approaches is multi-criteria decision-making. Process features AHP Is shown in Figure 3-3.

- Unity and uniqueness of the model: AHP is a unique model, simple and flexible to handle a wide range of issues without structure that is easily understandable for everyone.
- Complexity: to solve complex problems, AHP's systematic approach and fractional combined analysis applies. Generally, people have a holistic and detailed analysis and general issues or to leave. While AHP applies both together.
- Solidarity and interdependence: AHP linear dependence into consideration. But to solve problems that are dependent on the applied non-linear components.
- The hierarchical structure[4]: AHP hierarchical organization of the components of a system. This type of organization complies with human thinking and components are classified at different levels.
- Measure: AHP has provided a measure of quality criteria and provides a method to estimate priorities.
- Adjustment: AHP logical consistency and judgments used in determining the priority measures provide.
- Integrating: AHP is to estimate the final ranking of each option.
- Balance: AHP priorities in a system depends on the factors taken into account and the balance between them and enables one to choose the best option based on the goals.
- Judgment and consensus among the: AHP insistence on collective agreements. However, a combination of various judgments can offer.
- Repeat the process: AHP enables one to define one's own judgments and decisions to correct and improve.

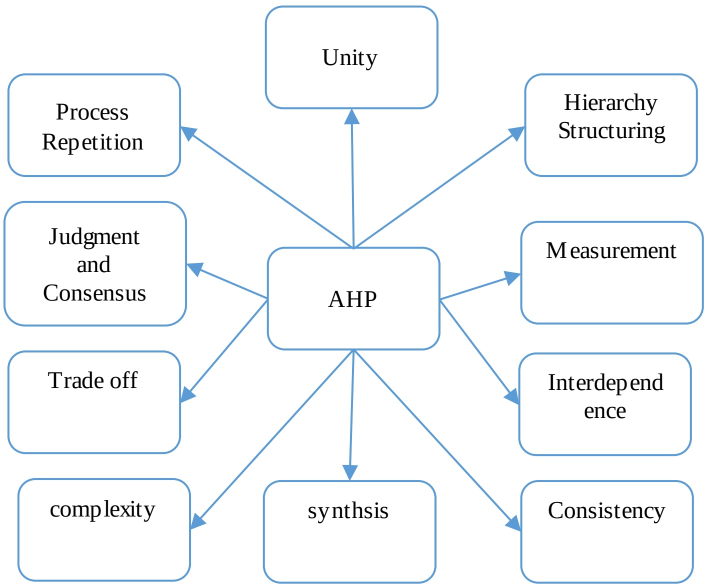

Figure 3.3: Features Analytical Hierarchy Process

According to Ugo, AHP Primary applications include: predict possible outcomes, plan events and offer desirable in the future, facilitate group decision making, control over changes in decision-making, resource allocation, select, compare the cost and revenue, evaluate and assign employees wage increases, given the choice of location, the proposed test location.

3.3.2 Stage Analytic Hierarchy Process

Analytical Hierarchy Process (AHP), a technique that is used to rank a set of options or to choose the best, from a set of options to be used. This way when the action decision and multi-criteria decision-making is faced with several competing options, can be used. Criteria can be qualitative or quantitative.

The practical application of analytic hierarchy process involves four basic steps. If the procedure is generally designed in two phase's hierarchy and classification assessment, the first stage in the design phase and next steps in the second phase, the evaluation phase is (Figure 3-4).

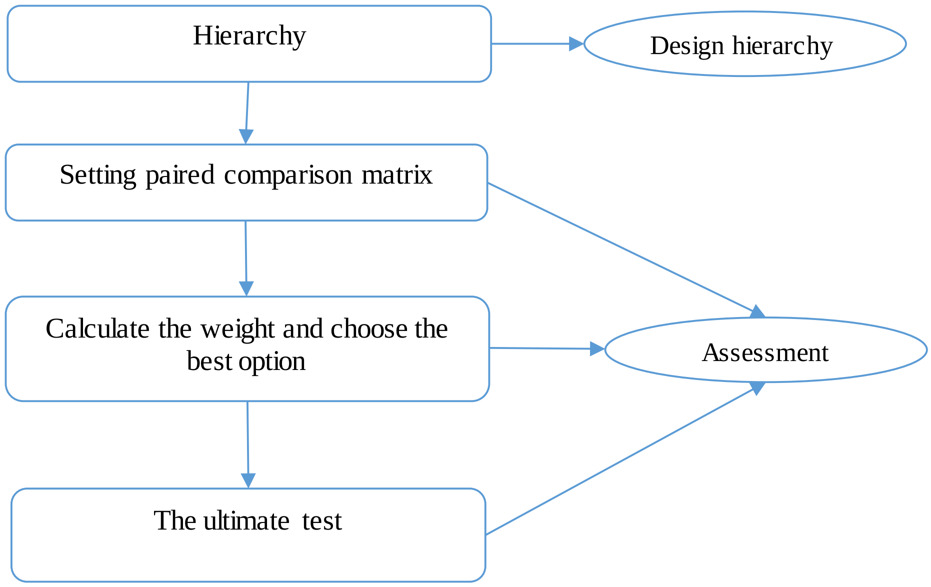

Figure 3.4: Analytic Hierarchy Process(Burge, 2011)

3.3.3 The hierarchical graph

Analytical Hierarchy Process is the first step in the hierarchy is usually in the order in which the objective, benchmark (if any sub-criteria) and options will be displayed. Of the hierarchy of decision factors compared and evaluated competing alternatives in making shows. For this purpose, create a graphical representation of a problem in which the objective, criteria and options shown are necessary. In Figure 3-5, for example, a hierarchical graph is shown. The goal is always to show a level in the hierarchy and the lowest level, the decision-making suggests options.

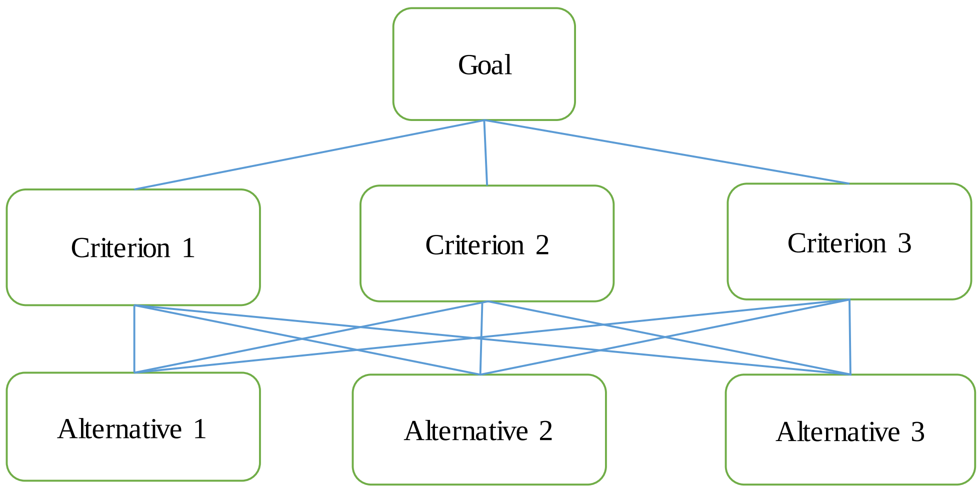

Figure 3.5: Hierarchy Chart

The hierarchical method depends on the type of decision has to be made in different ways. There is no limit to the number of levels in a hierarchy. The following criteria are criteria may be numerical or qualitative parameters such as high, medium and low.

Hierarchies are divided into two categories as follows:

- **Structural hierarchy:** In a hierarchical structure elements are generally physically associated with each other.
- **The hierarchical task:** In a hierarchical task for credit or functional components linked together to form a system the day. Each task hierarchy is made up of a series of levels that exist at the highest level horizon of an element called that goal, but in later levels there may be more elements. The number of these elements can`t be high and usually between 5 and 9 elements.

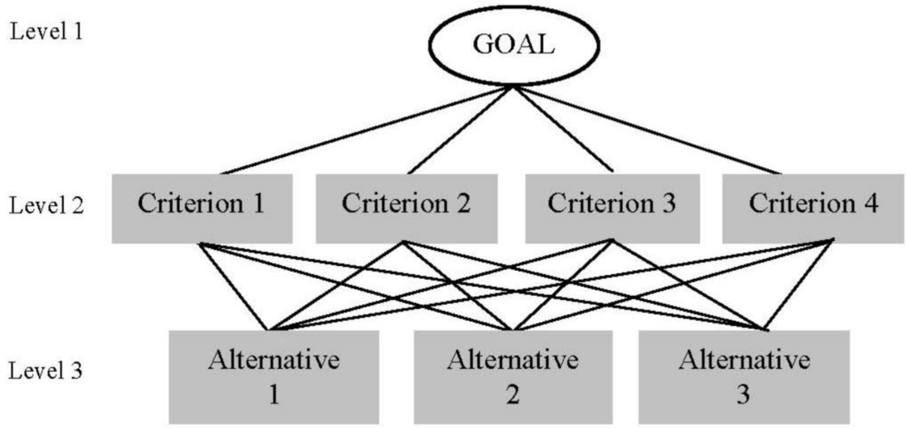

Figure 3.6: Hierarchy Chart with sub

Sometimes measure must also be analyzed so in this part we have new level, this type of hierarchical, call multi-level hierarchy complete.

In this context there are recommendations that will help to build a hierarchy include:

- To determine the ultimate goal and that of the hierarchy and most important question is what purpose are you pursuing?
- Determine the purpose of minor
- Specify the measures that are effective in minor goals.

- Determine criteria and sub criteria carefully as possible under the numerical criteria for distance or for little like high, medium and low.
- 5. Factors and sub-factors and the next levels.
- 6. Determination of options and exits.
- 7. In some cases the best option for the two hierarchical one another for profit and is useful for a fee. The benefit-cost ratio accounted for the largest proportion of its option is selected. Also in some cases to decide yes - if this method can also be used.
- 8. The decision of the two modes (yes or no) options can be considered for performance or non-performance.

3.3.4 Weight elements in AHP

Weight in AHP is calculated in two ways

a) Calculate the relative weight

To calculate the weight of analytic hierarchy, each level of your element at a higher level than in pair-wise comparison matrix is formed and compared. Assigning a numerical score of either or both of the paired indexes based on Table 3 - 3 takes place.

A paired comparison matrix is shown as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} \qquad (3\text{-}3)$$

Where in image Preference element image I am of the element image I was. Paired comparison criteria are established in relation to one another as follows:

$$a_{ij} = \frac{1}{a_{ji}} \qquad (3\text{-}4)$$

Table 3.3: Allocating points to the importance of standards.

Numerical Rating	Compare the relative indices (oral judgment)
9	The absolute importance
7	The importance of a strong
5	Strong importance
3	Poor care
1	Equally important
2, 4, 6 and 8	Preferences between these intervals

Paired comparison matrix $n \times n$ in which n is the number of elements that were compared is. For each pair-wise comparison matrix $n \times n$, elements on the diagonal of the matrix is equal to a need to assess, but other matrix elements should be determined on the basis of paired comparison. Elements are reversed with respect to the original diameter. The number of paired comparisons for each pair-wise comparison matrix $n \times n$ equal to:

$$N_h = \frac{n(n-1)}{2} \tag{3-5}$$

In general, if the decision-making m Options n Criteria should be n Pair-wise comparison matrix $m \times m$ and a pair-wise comparison matrix $n \times n$ are created. Therefore, comparing the number of hierarchy (the problem) is with:

$$N_h = \frac{n(n-1)}{2} + n \times \frac{m(m-1)}{2} \tag{3-6}$$

After determining the matrix of pairwise comparison, the relative weight of elements is calculated. There are different methods to calculate the relative weight based on paired comparison matrix that matter most to the least squares method, method of least squares logarithmic, of eigenvector and measures approximately of them. Among these methods are, especially vector method is more accurate.

b) The method of least squares: the next discussion will be told that if the matrix A consistent, we have:

$$a_{ij} = \frac{W_i}{W_j} \qquad \Rightarrow \quad W_i = a_{ij}.W_j \tag{3-7}$$

But in practice it rarely happens that the matrix is consistent. The least squares method is tried values

$Wi\,, Wj$ Be determined in such a way that the sum of the squares of the differences $Wi\,, Wj$ and aij is minimized. In other words, the following linear programming problem solved:

$$\begin{aligned} &Min\ Z = \sum_{i=1}^{n}\sum_{j=1}^{n}\left(a_{ij}.W_j - W_i\right)^2 \\ &s.t:\ \sum_{i=1}^{n} W_i = 1 \\ &\quad\ \ W_i \geq 0 \qquad i = 1,2,\ldots,n \end{aligned} \tag{3-8}$$

This problem can be solved from the Lagrange multipliers method:

$$L = \sum_{i=1}^{n}\sum_{j=1}^{n}\left(a_{ij}.W_j - W_i\right)^2 + 2\lambda\left(\sum_{i=1}^{n} W_i - 1\right) \tag{3-9}$$

We derivative Wi of the above equation to:

$$\sum_{i=1}^{n}\left(a_{ij}.W_l - W_i\right)a_{il} - \sum_{i=1}^{n}\left(a_{il}.W_l - W_i\right) + \lambda = 0 \qquad l = 0,2,\ldots,n \tag{3-10}$$

High non-homogeneous equations, linear equations and unknowns can be obtained. For example, we have, for example: $n = 2$

$$\begin{aligned} &\left(a_{11}{}^2 + a_{21}{}^2 - 2a_{11} + 2\right)W_1 - \left(a_{12} + a_{21}\right).W_2 + \lambda = 0 \\ &-\left(a_{12} + a_{21}\right).W_1 + \left(a_{12}{}^2 + a_{22}{}^2 - 2a_{12} + 2\right)W_2 + \lambda = 0 \\ &W_1 + W_2 = 1 \qquad .. \end{aligned} \tag{3-11}$$

For $n = 3$ we have

$$\left(a_{11}{}^2 + a_{21}{}^2 + a_{31}{}^2 - 2a_{21} + 3\right)W_1 - \left(a_{12} + a_{21}\right).W_2 - \left(a_{13} + a_{31}\right)W_3 + \lambda = 0$$

$$-\left(a_{12} + a_{21}\right).W_1 + \left(a_{12}{}^2 + a_{22}{}^2 + a_{32}{}^2 - 2a_{22} + 3\right)W_2 - \left(a_{23} + a_{32}\right)W_3 + \lambda = 0$$

$$-\left(a_{13} + a_{31}\right).W_1 - \left(a_{23} + a_{32}\right)W_2 + \left(a_{13}{}^2 + a_{23}{}^2 + a_{33}{}^2 - 2a_{33} + 3\right)W_2 + \lambda = 0$$

$$W_1 + W_2 + W_3 = 1 \tag{3-12}$$

These equations can be solved variables W_1, W2 and λ calculate:

c) Logarithmic least squares method: As already mentioned, the compatibility or incompatibility of the order states that:

$$a_{ij} = \frac{W_i}{W_j} \qquad \Rightarrow \quad a_{ij} \frac{W_i}{W_j} = 1 \tag{3-13}$$

$$a_{ij} \neq \frac{W_i}{W_j} \qquad \Rightarrow \quad a_{ij} \frac{W_i}{W_j} \neq 1 \tag{3-14}$$

In the method of least squares logarithmic attempt to capture the result of multiplying the differences are minimal differences in other words, the geometric mean is minimized. Disputes geometric mean is:

$$\left(\sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} \frac{W_i}{W_j} \right)^{\frac{1}{n^2}} = Z^{\frac{1}{n^2}} \tag{3-15}$$

In other words, states have compatibility or incompatibility respectively:

$$\sum_{i=1}^{n} \sum_{j=1}^{n} \left(Ln\ a_{ij} - Ln\left(\frac{W_i}{W_j} \right) \right) = 0 \tag{3-16}$$

$$\frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} \left(Ln\ a_{ij} - Ln\left(\frac{W_i}{W_j} \right) \right) = \frac{1}{n^2} Ln\ Z \tag{3-17}$$

Since the brackets may be negative in some cases and in some cases is positive, it will be two heads to always be positive. Therefore, this procedure must solve the following linear problem to values Wi Achieved:

In general, ordinary least squares method, mean geometric mean log errors and least squares method minimize errors.

$$Min\ Z = \sum_{i=1}^{n}\sum_{j=1}^{n}\left(Ln\ a_{ij} - Ln\left(\frac{W_i}{W_j}\right)\right)^2$$

$$s.t.\quad \sum_{i=1}^{n} W_i = 1$$

$$W_i \geq 0 \qquad i = 1,2,\ldots,n \tag{3-18}$$

D) The specific vector method: the method of calculating the relative weight, especially vector method is more accurate. In this way, Wi Are designed to be established that the following equation (Saaty, 1980):

$$A.W = \lambda.W \tag{3-19}$$

Where in λ And W Respectively paired comparison matrix eigenvalues and eigenvectors A is. In the case of larger matrix size is too time consuming to calculate these values. Thus, for calculating λ the determinant of the matrix $A - \lambda.I$ placed equal to zero by providing the largest amount λ the resulting values in the following equation W it will be counted.

$$(A - \lambda_{\max}.I) \times W = 0 \tag{3-20}$$

Theorem: For a positive and inverse matrix (such as pair-wise comparison matrix) Special vector can be calculated from the following equation:

$$W = \lim_{k \to \infty} \frac{A^k.e}{e^T.A^K.e} \tag{3-21}$$

Where it is $e^T = [1 \quad 1 \quad \ldots \quad 1]$ (3-22)

e) The approximate methods

These methods are less accurate than previous methods but also will have fewer calculations. These methods are mainly approximate eigenvector methods with different accuracy of calculations easy. These are the most important of methods:

Total Row: In this method, the calculated sum of the elements of each row to a column vector obtained. This vector is normalized column, the weight vector.

Total column: In this method, the total of each column computed a row vector obtained. The elements of this vector are reversed. The row vector is normalized, the weight vector.

Mean: In this method, each column, each row vector is normalized and the average weight is achieved.

Geometric Mean: The geometric mean of each row is calculated. The resulting vector is normalized, the weight vector.

The weight of each factor reflects the importance and value of other factors. Therefore, the correct choice and weights of great help to determine its intended purpose.

Operation weighting factors shall be done in three ways.

- Use of expertise: in this way, using the experience and knowledge of experts in the field of intended use and taking into account the characteristics of the study area, appropriate factors and weightings would be. The advantage of this method is that it is simple and documented. But this method has some disadvantages such, the risk of confusion experts in determining the weight and size of the standardization problem of mental ones.
- Use of data: data knowledge is based on the information available about the answer. The knowledge data using the solutions available in the location -finding and calculation of the dependence of each invoice to answer, we can determine the weight of each factor. In this way, the probability of occurrence is less wrong, but just its performance depends on the accuracy of solution is available.
- 3) The use of expert knowledge and data simultaneously. In this way, according to the results of the knowledge and experiences of experts and use of the information, to receive each of the weighting factors. By first calculating weights through expert knowledge and data separately, and then the desired weight is determined by comparing the values obtained. Resulting in reduced probability of false weights closer to reality than they were.

f) Calculation of the final weight

The final weight of each item in a hierarchical process of the product multiplied by the weight of each criterion score achieved the desired option. The total score obtained for each option the relationship below is obtained:

$$i = 1, 2, \ldots, m \qquad A_{AHP_{score}} = \sum_{j=1}^{n} a_{ij}.W_{ij} \tag{3-23}$$

Where in aij Indicate the relative importance Options i I for index $C\ j$ And $W\ j$ Show the importance of j . Also it is necessary to value of alternatives and weights using the following relations are normalized.

$$\sum_{i=1}^{m} a_{ij} = 1 \qquad j = 1, 2, \ldots, n \tag{3-24}$$

$$\sum_{j=1}^{n} W_j = 1 \tag{3-25}$$

3.3.5 Rate of incompatibility

One From The advantages of the process analyze Hierarchy Process (AHP) monitoring compliance decision Is, To The other has At The process of analyzing a series of hierarchical be the adaptation decision Calculate Did And Ratio To Good And Bad to be And Or Able Acceptance and rejection of it Verdict A . If A double B is important and B Triple C importance Have Is, so what A six-fold C is important, this Verdict and Compatible say. If you prefer A to C be a different number than six, for example, 5 judgments in this case, the compatibility is low. With Attention to This is consistent reasonable judgment of the Use by at Determine the priority of Necessary There should be consistency of judgments review be.

If n criteria as $C_1, C_2, \ldots, C_n$ they have paired comparison matrix is as follows:

$$A = \lfloor a_{ij} \rfloor \qquad i, j = 1,2,\ldots,n \tag{3-26}$$

Where in a_{ij} Preferred measure C_i On C_j , The matrix A consistent 40 in the matrix if we say:

$$a_{ik} \times a_{kj} = a_{ij} \qquad i, j, k = 1,2,\ldots,n$$

- If the matrix A is compatible with:

$$a_{ij} = \frac{W_i}{W_j} \tag{3-27}$$

- Weight matrices compatible through normalization of columns can be achieved.

If an incompatible Pair-wise comparison matrix is, how much of the conflict and how much of it. Inconsistency is better to measure the expression of several important cases should be mentioned:

- For each pair-wise comparison matrix (positive and negative), if λ_1 , λ_2 … and λ_n Eigenvalues of matrix pair-wise comparison, the total eigenvalues of the n (the matrix) will be:

$$n = \sum_{i=1}^{n} \lambda_i \tag{3-28}$$

- The maximum eigenvalues ($\lambda_{\max}$) always greater than or equal to n (in the case of some λ Will be negative).

- If a small amount of matrix elements compatibility mode distance, its eigenvalues is also a small amount of the adjustment will be.

On the other hand, by definition matrix for each square of A , we have:

$$A \times W = \lambda . W \tag{3-29}$$

Where in W And λ Respectively eigenvector and eigenvalues of matrix , respectively. In the case of matrix A consistent, a special amount equal to n (the maximum eigenvalues) and the rest are zero. So in this case, can write:

$$A \times W = n . W \tag{3-30}$$

In the case of pair-wise comparison matrix A is incompatible, image A little bit of n distances that can be recited:

$$A \times W = \lambda_{\max} . W \tag{3-31}$$

Since the ($\lambda_{\max}$) is always greater than or equal to n . If distance matrix bit compatibility mode ($\lambda_{\max}$) of n will be a little distance. So the difference $\lambda_{\max}$ and n ($\lambda_{\max} - n$) A good measure of the size of the matrix will be the incompatibility. Undoubtedly scale $(\lambda_{\max} - n)$ the value of n (the matrix) dependent and this dependence can scale to meet the following way define it mismatch index ($I.I.$) they say.

$$I.I. = \frac{\lambda_{\max} - n}{n-1} \tag{3-32}$$

The inconsistency index for the numbers of random matrices are available, has calculated that it random incompatibility index) $R.I.I.$(Named are the values for the matrix n second on the following equation or table 3. 4 calculated

$$R.I.I = 1.98\frac{n-2}{n} \tag{3-33}$$

Table 3.4: random inconsistency index

N	16	17	18	19	20	21	22	23	24	25
RI	1.59	1.6	1.62	1.63	1.63	1.64	1.65	1.65	1.66	1.66
N	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**
RI	1.67	1.67	1.67	1.68	1.68	1.68	1.69	1.69	1.69	1.7

The resulting matrix is divided for each incompatibility index 43 index criterion used to judge the incompatibility coincidence then that it is incompatible inconsistency rate ( ) $I.R$

$$I.R. = \frac{I.I.}{R.I.I} \tag{3-34}$$

Inconsistencies in the method of calculating the rate of AHP is also of high importance. In general, an acceptable level of incompatibility of a system depends on the decision maker,

But the Saaty number as an acceptable 1.0 provides and believes that if the mismatch is greater than 1.0, it is better judgments appeal.

3.4 The method is similar to Ideal

The method is similar to the ideal option provided by the ion and Huang in 1981 that was welcomed by researchers and various users. In this method, the choices are ranked based on similarity to ideal solution, so that more and more like the ideal solution is an option, higher rank. This technique is making a strong mathematical background and, like most scientific methods, to know and comply assumptions, scope and conditions of validity and accuracy of the formulas proposed rules, the range of acceptable accuracy of the results and the answer is very important. This is the definition of the concept of "ideal solution" and "similarity to ideal solution" is used. What is the ideal solution as its name implies, in order to measure the similarity of a plan (or option) to the ideal and anti-ideal solutions, from the design (or option) and anti-ideal of the ideal solution is measured, Option based on the distance from the anti-ideal solutions are the ideal solution and anti-ideal position to evaluate and ranked? The assumptions underlying this technique are:

- The utility of each unit should be uniform, increasing and decreasing. In other words, whether qualitative or quantitative measure of the desirability of changing the amount is increasing or reducing.
- Criteria must be considered to be independent of each other.
- Since the exchange rate between the norms usually a non-single-slot solution, ideal and anti-ideal options for the Euclidean distance is calculated.

3.4.1 The advantages of this method include multi-criteria decision-making:

- In case of positive decision-making criteria and standards possible negative while the Analytic Hierarchy Process method to criteria such as positive response.
- In a way, such as the Analytic Hierarchy Process effectively and naturally in this area there are limits.
- This method is simple and has good speed and is responsible for a large number of options and criteria well.
- In this way, you can easily copy qualitative criteria the decision despite both qualitative and quantitative criteria is possible.
- In this way, the original data standards according to the weight criteria will be considered. The answer depends on the weight that is given by the decision-making criteria. Fortunately, some reliable methods such as entropy weights have been identified to assess the utility of the procedure have increased.
- Output System quantitatively and to determine the preferred option out other options numerically expressed. The numerical value of the relative proximity is a strong base of this method states.

- The importance of the visibility factor measures the impact on numerically rank the options there.

3.4.2 Method steps similarity to ideal solution

If you have a problem of multiple criteria decision making criteria and m has the option, in order to choose the best option of using similar methods to solve ideally, the procedure is as follows:

3.4.3 Decision making matrix

Given the number of criteria and the number of options and evaluate all options to various criteria, decision matrix is formed as follows:

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \cdots & \cdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \tag{3-35}$$

In figure A.1 you can see how make the ideal matrix

3.4.4 Scale up the decision making matrix

At this stage, we try to show different aspects of the measures no later become the criteria and the matrix R is defined as follows:

$$R = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \cdots & \cdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix} \tag{3-36}$$

Scale there are several different methods, but the method similar to Ideal usually the following formula is used:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \tag{3-37}$$

If the distance between the measured values is not substantial, can be used to Scale positive and negative criteria used by the following formula:

$$r_{ij} = \frac{x_{ij} - \min\{x_{ij}\}}{\max\{x_{ij}\} - \min\{x_{ij}\}} \tag{3-38}$$

$$r_{ij} = \frac{\max\{x_{ij}\} - x_{ij}}{\max\{x_{ij}\} - \min\{x_{ij}\}} \tag{3-39}$$

3.4.5 Determining the weight matrix

At this stage, due to the different weights of the criteria in decision-making matrix is defined as follows:

$$W = \begin{bmatrix} w_1 & & 0 \\ \vdots & w_2 \cdots & \cdots \\ 0 & \cdots & w_n \end{bmatrix} \tag{3-40}$$

The matrix W is a diagonal matrix is the only non-zero elements on the diagonal and amount of these elements is equal to the significance level for the corresponding vector.

3.4.6 Determining the scale up weight matrix

The decision matrix, decision matrix Scale is weighted by multiplying the weight matrix criteria is:

$$V = R \times W = \begin{bmatrix} v_{11} & \cdots & v_{1n} \\ \vdots & \cdots & \cdots \\ v_{m1} & \cdots & v_{mn} \end{bmatrix} \tag{3-41}$$

3.4.7 Find solutions ideal and anti-ideal

Ideal and anti-ideal with this form:

$$A^* = \left\{ v_1^*, v_2^*, \ldots, v_i^*, \ldots, v_n^* \right\} \tag{3-42}$$

$$A^- = \left\{ v_1^-, v_2^-, \ldots, v_i^-, \ldots, v_n^- \right\} \tag{3-43}$$

Of all the options and the best value i $^{\text{Th}}$ standard i$^{\text{th}}$ worst value is the measure of all the options. And the options are, respectively, indicating better gaming options are quite worse.

3.4.7 Calculate the distance from the ideal and anti-ideal solutions:

At this stage, for each option is the ideal solution to solve anti ideal distance is calculated as follows respectively:

$$S_j^* = \sqrt{\sum_{i=1}^{n} \left(V_{ij} - V_j^*\right)^2} \tag{3-44}$$

$$S_j^- = \sqrt{\sum_{i=1}^{n} \left(V_{ij} - V_j^-\right)^2} \tag{3-45}$$

In this regard, j represents the index i represents the criterion and index options is desirable.

3.4.8 Similarity index

In the final stage similarity index is calculated by the following equation:

$$C_j^{\ *} = \frac{S_j^{\ -}}{S_j^{\ *} + S_j^{\ -}} \tag{3-46}$$

The similarity index between zero and one is changed, the item is more similar to the ideal, and the index value will be similar to the one closer. It is quite obvious that if A_j = A *, then one would be equal to zero and similarity index it and if $A_j = A^-$ to zero and then the similarity index will be equal to zero. The options are ranked based on similarity index value will be, therefore, is the option that has the highest similarity index, Thus, the option that has the highest similarity index, has the highest rate option that is the least similarity index, it will be the last place.

4 DATA COLLECTİON

4.1 General information about Sarcheshmeh Copper Mine

Sarcheshmeh Copper Mine, one of the most important copper - molybdenum porphyry in the world. This mine in 160 kilometers South West of Kerman and Rafsanjan 50 km of the South West and set in the highlands of tetanus Mamraz.this city functions and longitude of efficiency '55 º 53 East of the geography of efficiency '58 and º 29 north and at an altitude of 2,600 meters of surface located in the round of ten (Khorasanipour *et al.*, 2011),(Jannesar Malakooti *et al.*, 2014). The access roads to the mine through a road of Rafsanjan, Kerman tarmac Sarcheshmeh Copper Town - Sarcheshmeh Copper Complex of the distance between Bandar Abbas is 437km. The height of this region from sea level to an average of 2620 m and the highest point from sea level it 3280 m high. Sarcheshmeh copper mine due to exposure in mountainous areas is a regional cold and temperate. During the cold period in the region, long with snow, rain and cold winds and summer is mild and temperate Annual changes of temperature of-15 to + 32 ° c.

4.2 Geological time Sarcheshmeh Copper Mine

Sarcheshmeh Copper Mine deposit located in the center of a mountain. That mountain is consisting of folded sedimentary and volcanic materials. On the southern edge of the West in an area there is a placed that it called trust zone. That includes rock and stone in the third period and fault Metamorphic and Paleozoic sedimentary rocks and the Zagros Mountains. The mass above the one set in the side of the quartz depends more important. The intrusive phases of mineralization cut by dikes, most of these dikes is approximately N25W(Ebrahimabadi and Alavi, 2013).

Figure 4.1: Facade of Sarcheshmeh Copper Mine

4.3 Geological time warp of Sarcheshmeh Copper Mine

Generally, geological time warp of area may be divided as follows in paragraph indications of poison:

- A series of submarine deposited thick andesite, tuffs and layers in the Eocene period 50 to 60 million years ago.
- Biotite-hornblende diorite intrusion with a mass of 2 km northwest mining area in the valley folds' ejection and possibly volcanic rocks.
- Influence of the team an expensive stock to the side of the team Granit stones Vulcan in one in the period of age or earlier (more than 115 million years ago).
- Stoke influence of firmware Granit its performance of the team the Vulcan stones one in the period of age or earlier (more than 115 million years ago).
- Stoke severe cracking and volcanic rocks surrounding by Argilization, Silicification, and mineralization.

- At the same time with phases of alteration dike with low and scattered mineralization penetrate the order they have been usually fitted to the North-North-West. Last dike influence 4m years ago.
- Erosion and porphyry appear set and get washed and oxidation of land surface near sulfidic
- Vulcan eruption of lava and stones for the formation of the younger one.
- Deposition of travertine stone as one of the region Wes Bos of Le springs of hot water in the early Vulcan one in the fourth period at this time.
- The formation of the attributes of the current post to continue the formation area, erosion washed with some of copper oxide and secondary fortified area.

4.4 Rock ore deposits geological origins

Vulcan stones in the area of the origin of the nature of the seeds and division of the strap portion

Apart from these stones fully twenty of the head. In general, within the scope of the mining of the stones there.

- Andesite: Height of the rock in this area is fresh and has the texture of the grain is in the day. These rocks are rocks in the language of the van under the impact of alteration of the race, we can say that more than half of Article B of mine in the Andes of these are at the borders of the mine area are located there.
- The origin of the Porphyry: Stoke is the main source of the same stone and copper mineralization is associated with this mass. This stone is made of granodiorite composition and textures are variable. It quartz veins and the field of sugar and the livelihoods of Plagioclase phenocrysts, hornblende and b oat nature of these rocks are in the tens of fluctuation.
- 3. Porphyry of the type-A: These rocks are fine grained quartz monzonite porphyry than the source. Porphyry copper mineralization in these rocks is less than the source. The dark background than the source porphyry rocks. In this type of stone is sometimes seen in older rocks in the area.
- Dikes: Has a porphyritic texture with fields of grain is smaller than the source porphyry. younger than this one in the deposit originates in the center of the bearing pad of wet through and by the coarse nature of the field of the L line of

the grain of the characterized feldspat. Phenocrysts of the oat include the nature and amounts of the quantitative Plagioclase.

4.5 Familiar with the amount of stored Sarcheshmeh Copper Mine

The amount of stored copper mine, the source is given in Table 4 -1

Stored above the L of approximately 22 million tons of ore containing copper minerals of the structure of the type of work that is economical 76/0% c to teach it to do part of the project l of copper for how water is used Nag and the ordered.

- 200/527/812 value of the ore body containing metal as of the mole of 027/0%.

Table 4.1: the amount of classified and stored in Sarcheshmeh copper mine**.**

Rejection of F	Type of Stored	The amount of stored (tons)	The average of (%)
1	Proved Reserves	1057280650	0.74
2	Probable Reserves	99060350	0.41
3	Possible Reserves	67546400	0.29
4	Total	1223887400	0.69

- The amount of trace elements of water: 27/0 grams per ton of gold ore and 9.3 grams per ton silver and the other trace elements of water, which is currently the only gold and silver open water is assigned.

Sarcheshmeh copper mine have got many types of mineral elements like: Au, Mo, Ni, Zn, Pb and Ni(Einali, Alirezaei and Zaccarini, 2014).

4.6 General characteristics of the Sarcheshmeh Copper Mine

Step height of 5.12 meters and a width of Sarcheshmeh copper mine stairs 75/8 meters. Also full of one child per 4 steps, of a width of 75/23 meters wide stairs replaced. The final slope walls of the mine are currently in the 34 to 36 degrees. Also, the road width of 30 meters and the B Mine has been in the 8%.

Oval-shaped lump ore and grade of 25/0 percent in view of the large diameter and small diameter oval about 3 km, about 2 km The mineralization zones, different parts of the deposit into three regions oxide, supergene and divided Hypo genic. As the extent of carrying the crushing of 25/0% and as of autumn than the 15/0% of waste sent to Damped fluctuation. Between 25/0 and 15/0%

of as a% of Damped depot is low grade. In the face of that as of 25/0% but higher than the percentage of the X Copper (CuO) of greater than half a percent as copper. The (% CuO>% Cu), and for the extraction of copper ore is the structure of the L method for how the war is forwarded.

4.7 The Sarcheshmeh Copper Mine Development Project

Now the 20-year development plan for the mine to two projects in the planning of the first and second. 1393, the fourth year of the first development plan is extracted. Maps of the mine extraction development plan for 5 years, 10, 15 and 20 of the bottom hand of consulting company. In recent decades, environmental, political, economic, social and cultural, in the creation of new places and diversify the places and culture, has left deep effects. In such an environment where users are required to use appropriate methods and tools can no longer focused on traditional tools and methods. Location decision is a major issue for planning new development, specially within the planning of new healthcare infrastructure (Dehe and Bamford, 2015),(Lin and Tsai, 2010).

4.7.1 Loading

Now in Sarcheshmeh Copper Mine, the number 3 number 15 m^3, 9 shovel in 12 cubic meters, 6 5/9 shovel cubic meters, other small shovels, 5 0 number 150-ton trucks, 40 ton and 35-ton truck 100 tons and some 60 trucks are employed.

4.7.2 Factors in determining the location of the mine crusher system

Since the stone crushers in a wide variety of mineral and each have their own characteristics. The features on the site are not necessarily effective. For example, stone crushers a state of semi-fixed inside the mine to the crusher are all moving in on your site maximum duration of 10 years’ experience in a few days. Naturally, the longer the time, the importance of the site is added. For a semi-mobile crusher or removable remains that for several years at a site, the importance of economic studies, safety, geotechnical, long distance and freight fire will be impressive. Instead, mobile crusher for a few days or weeks at a fixed site, careful planning is more important. Mobile crusher relatively high mobility (compared to others) creates the possibility that at the time of fire safety can be allowed to walk away (about 100 meters) that this issue should be on the other stone crushers be controlled.

Another issue that needs to be noted that the factors that affect the crusher site, are not always in the same direction. The fact is that in most cases, several factors are important in the decision against several other important factors, such problems may be on the local aspects Cargo balance to be observed but it is possible place loose earth or much of the establishment of the device there is no place. In these cases, it is difficult to decide who should be given the specific circumstances of each mine is the perfect option selected. But in any case must be considered economic aspects and safety.

The following factors influencing the site will be considered, but necessary orders in this case is that the parameters listed below, most of them are related to each other and cannot be considered apart.

4.7.2.1 Time to prepare the site crusher and track bar

One of the most important parameters affecting the assessment of the proposed areas for the deployment of site preparation Crusher and Crusher time, especially the bar. If the area is not limited strike if the capacity of the soil. But if the construction site and the tape needs to be cut crushers and excavators to prepare the site and the area to choose to deploy the affected crusher.

4.7.2.2 Mine capacity

The type of impact crusher mining capacity in the first phase and the second phase of the location and the site is effective. Usually mines that have a high capacity, one or two units of mobile or portable use stone crushers half. Despite such stone crushers should geotechnical issues, maintenance of walls, access roads, repair shops and ... more respected place. On the other hand, crusher necessarily has high capacity and supply capacity, larger and more tracks, conveyors and traveling more tracks with higher capacity is required as a result of greater area of the site requires.

4.7.2.3 The deposit of natural

If the deposit is in the form of a layer, the further expansion of mining in one direction and in a direction less development. The deposit only certain parts of the crusher, which can be concentrated in that part and reduce freight distances. In the meantime, crusher site at the waist usually comes down to mine development is less interference and therefore the site longer life. Conversely, if the mass ore deposit mining operations conducted in various parts of the site will increase the sensitivity. Also form deposits on the mine are also effective. For example, if deposit is horizontal or is that just as economic bit depth, should be stopped operations in depth and prolong the mine's development in the attacks, adding that the development of distance and changes in the cargo the cargo to crusher 9.

4.7.2.4 Distance

In this respect crusher should be in a position that route distances, such as repair shops, machine parts, etc. are balanced personnel rest room place.

4.7.2.5 Blast

Crusher should be safe moving of material thrown from the explosion traveled at the time of fire safety allowable distance (about 100 meters) and this may have an hour to waste time. But the stone crushers a few years at a fixed site, it's a different issue. If not take into account other parameters, the site must be located in a place that is away from launch explosion. In recent years to eliminate this effect, controlled explosions done yet sensitive parts of the equipment crusher and covered with a special device. Usually the walls of the crusher around the site with concrete walls to prevent the possible loss of further maintenance are kept. If the battery is done in close distance, there is the possibility of falling walls with a blast wave. In this case there must also be respected.

4.7.2.6 Safety

Safety is always the problem with the economy. In some cases, due to safety issues aside, but always safe and economic needs of the economy must balance. May be moved due to safety issues not only on location, but also to change the shipping method. Safety issues must be taken before the plan during the plan after the program and examined at the time of use. More safety in geotechnical issues appears, however, to items such as car traffic in the crusher, topography, etc. are also taken into account.

4.7.2.7 Appropriate space to establish Crusher

For grinding systems to moving along several units to each other. Devices such as the feeder, vibrating screen, crusher, conveyor, and machines such as tracks, shovel loaders, etc. is active on the site. The site must have enough space activities done correctly and does not return any car down. The site should be enough to maneuver the tracks, forklift trucks and cars have a server. Repair crusher and conveyors, if necessary, should be considered separate from other machines and it has created a crusher site.

Get the right amount of space cannot be achieved through the formula, but it is an experimental work that great care needs or at least this space is not obtained or not too little. If on site, excavation is necessary, the extra space lowers economic aspects.

4.7.2.8 Economic factor

In the mining industry, the economy always comes first (in the economy should be considered safety) all mining operations such as drilling, blasting, hauling and crushing equipment, including expensive items are considered. So far as can be upheld and economic aspects of the additional tasks are avoided. Economically, the site must be located in a minimum volume of excavation, the lowest along the conveyor, the shortest distance transport, the lowest number of tracks, the lowest supply route, less space and have the greatest safety. The economy has strong relationships with all other parameters in any of the other factors means the economy lays. The economy should be separated from other parameters.

4.7.2.9 Transportation

In this respect crusher should be in a position that bearing intervals are balanced. This means that the site should be at the center of the mine. Because in this case, the cost of freight to be minimal. Bearing that in this situation should try as much as possible be horizontal.

If these are not reasons to observe, the best situation is when the tracks load bearing crusher of downhill and uphill runs empty tracks.

4.7.2.10 Position relative to different locations mine crusher

a) In the first case, the crusher is located at the mouth of the mine and crusher truck load of work to do and freight front of the crusher to the secondary devices will be on the convey.

4.7.2.11 Staffing

It can be considered as a side issue. Usually crusher for full-time or more times a day to work. Therefore, it is necessary that the brightness of the lighting for the site's electricity supply. In addition to the crusher for crushing materials, electricity and fuel use to make your move. The problem in this regard is essential; bringing power lines to the site that is both cost and time to other machines creates some limitations.

4.7.2.12 No inconvenience to other machines

Elevator strip line that connects the mineral processing plant to the crusher site certainly passes through the mine. Around areas where the conveyor passes to the other side, there is the possibility of car traffic. Because the high cost of buying equipment, conveyors, conveyor must be connected in the shortest route to the factory. If the site is located in an area that gets the access roads to the mine conveyor belt passes, it becomes problematic. The site should be located in an area as possible that these parameters are not facing each other.

4.7.2.13 Maintenance bar during mining

Because after the installation and use of these systems require repairs bar during mining should take place, Because of the steep paths that crossed the bar, need to build a path and keeping track of costs during the project is very important. The breaking rocks in zones for the establishment of this parameter in terms of route ease of maintenance and repair work should be considered.

4.7.2.14 consistent and compatible with mine development

In large deposits such as copper mining, mine development in terms of depth and width Pete withdraw each year is rung in the pit. Because rock sand mining within half moving average every 3 to 5 years in a designated place, used to be. Therefore, the choice of location of stone crushers should be selected locally with mine development is compatible.

4.7.2.15 supply route

In surface mining and road traffic in terms of procurement Pitt much problem there,

But in discussing the transfer of mineral or waste outside the bar on routes that require a supply route Pete Becker, particularly on steep routes is important.

4.7.2.16 water waste

In the layout stone crusher inside the Pit water waste in the initial mine unaffected. But it is very important parameter in two modes. First, in the years of the life of mine who require rock crusher to step down more to be delivered, and if the water level is high groundwater. Locate the rock crusher will be in trouble. The latter, in the absence of some coal-mining regions affected by the water of the upstream surface is mine. Choose the stone crusher in these areas due to the transfer of water out of the pit, more affected than the rest of the.

4.7.2.17 noise and dust

The site should be located in areas that provide the lowest noise for the rest of mine.

4.7.2.18 environmental impact

This parameter has little effect on the selection of the rock crusher is in Pit, only in situations where the mine to residential areas, forests and other natural ... close, this parameter will affect. The environmental can be define like as public health and safety, social relationships, air and water quality and some various impacting factors from mining activities were estimated for environmental component(Monjezi *et al.*, 2009),(Fazeli and Osanloo, 2014).

4.7.2.19 Geotechnical

One of the important issues affecting the crusher site, geotechnical issues. In the mobile crusher that is constantly changing her location, But the stone Lithotripters that remain in one place for several years, is of great importance. In this case, several points must be considered. First, the crusher device that upper weight (from a few hundred to several thousand) is and the weight of great force to enter premises that are dangerous loose in the land. It is important that when the weight of the machine and other machines such as feeding, Conveyors, trucks, loaders, shovels, etc. to be added. May be landed and therefore have the sink device in the ground. However, this could be a factor for fragmentation of land and demolition site. Another issue is the high price of crusher and production. If you have not done a detailed geotechnical studies, and this later led to the loss of the site or part of it (in the advanced stage crusher loss) that we have to replace our site. In addition, cost losses will also stop production. The factors that cause land instability, such as sets, fault system, the gush of flooding (this phenomenon occurs in clays) Cut loose aquifer and water, land flowing soils and geotechnical other events that will lead to failure and instability earth, and the establishment of the crusher should be checked carefully avoided in these places. If the groundwater causing instability site must be drained and in some cases it is necessary to consolidate the land.

4.7.2.20 roads and ramps

Create logistical roads along the conveyor, as well as Ramps for tracks that load transfer from the front to the crusher, is very costly. As well as their maintenance creates the idea that these costs should be lowered as much as possible. But these costs are directly related to the crusher site. Choosing the right site crusher can eliminate many of the items costs.

4.7.2.21 topography of the pit and the bar

If the mine is located on a hillside and is set to be created from scratch crusher site, it has an impact. The steep increase in the volume of the excavation site and in addition, lowers immunity. Contact the factory conveyor facilities as well as in such places simply not possible mineral and plant depending on the location and topography, we have or the apparent dip and twist conveyor and thus increasing the supply routes and if necessary, evacuation shot or by creating wells and tunnels inclined to reach our goal that in any case the cost will be high. In addition, there is the river and flood flows that pass through or near the mine, and shall not affect the site's location on the site such obstacles created.

4.8 The benefits of this approach are:

- The site is always fixed crusher and a new set of problems, and the transfer device.
- There are no access problems at the mine.
- inclined tunnels and special transportation bar is not necessary.
- The return on investment starts earlier.
- It can be fixed stone crushers that cost less than other types, respectively.
- Powering and preparatory work is done easier.

4.8.1 The disadvantages of this method are as follows:

After a while the increase in truck cycle, the system moves away from the initial economic situation. The method for small holes (up to 400 meters deep) is effective. Because the mines are not economic with more depth trucks.

b) In the second method, is transferred into the mine crusher and placed in a good place. After some time on the floor and attacks with mine development, should be changed crusher site and balances are respected broker in the mine. The benefits of this approach are:

- Bearing always in balance and in terms of operational costs, the best method.
- There is no need for trucks are not high. Front crusher is low because the distance to do so.
- This method can be applied to a depth of 700 meters and more.

4.8.2 The disadvantages of this method are as follows:

- Where the conveyor is installed, there is no communication with the other side of the mine.
- The existence of an inclined tunnel is necessary.
- Every few years have changed the location of sites and equipment that adds to the difficulties.
- The site should not interfere with mine development.
- In the third method, ore crusher is installed in the floor and materials through trucks to crusher and from there to a vertical or inclined passage substances that are manufactured, using the force of gravity is passed down a power bus

installation of the material behind it is collected and fed to the conveyor or wagon. Conveyor and cars received material depending on the design and shape of the deposit and topography directly or through a vertical well with Netscape out of the tunnel and sent to the factory. This method is usually used in a few of which include:

- The shape and location of the deposit is around so that we can pass a drug and a horizontal tunnel being installed in the tunnel conveyor rail system, transport system formed.
- The depth of the deposit is such that if in some horizons, the cost of building the Escape and pass conveyor systems and material handling compared with a system, this system is superior.
- Shape and deposit as an introduction to underground mining or open-pit mining dictates that these operations are combined together.

The following factors are usually effective in the implementation of this method:

Safe passage wall, geological conditions, weak and hard rocks need to cover the steel and concrete and wood, the size of the surface material at the bottom of the bus, the bus, the bus slope, grinding and bulk material properties, size ore lump and mass distribution the moisture content of the deposit, weather conditions such as rain, snow and freezing.

4.8.3 Advantages of this method include:

- Material Handling is done by truck downhill and trucks are empty when returned.
- Important part of the cargo carried by gravity.
- Open pit and underground mining can be done at the same time and a transport system for it to consider.
- In deep mines is more economical than other methods.
- The operating cost is low.

4.8.4 Disadvantages of this method include:

- Large capital costs for the construction of crossings, tunnels and vertical wells and equipment within each need.

- Preparation time it is.
- Netscape great potentials may not work.
- The existence of several transportation systems (trucks, conveyors or train, Netscape and other systems for transporting materials from the wells to the plant) maintenance its own skilled personnel and demand that the advantage is losing ground.

Most of the time each mine has its own conditions and factors affecting each with another. The factors that are often involved in decisions and choices would make in another way. In general, we can say that the shallow open pit mining should be placed at the mouth of the crusher.

Another important system issues within the mining crusher, crusher site's position in relation to other parts of stairs, ramps and is blown. In addition, if the crusher to be installed at the foot of the stairs, connecting conveyor to the next part of the problem. In the case of ramps, ramps, but not in the near crusher put it to disturb the movement of other cars and trucks and cars not crusher server to reach in the shortest possible time.

About Cutie, crusher should be installed in areas of low grade and waste as much as possible in order to not interfere with mine development at the site could be maintained for several years. The layered deposits, crusher is installed in the back of the bottom layer to the stripping and deposit operations from interfering. In addition, the sides of the waist down in these cases are always less developed than waist high. Study stairs map indicates that the tailings, minerals and other materials where mines are located and the fact define a first place for the crusher.

4.9 Determine the mineral crusher site

The most important feature of a site within the mineral crusher reducing operational costs. The site should be located in local operating expenses, conveyor belts, trucks and minimized the number of trucks. If a particular site by the end of mine life to consider crusher. A study in this area has shown that every site more than two years cannot be economic. So with the introduction of the permanent installations, freight costs will be enormous after a few years.

To comply with the economic characteristics of this method, the sites periodically newer place with better economic conditions moved. The important thing is to find a new location. It needs an economic program - considered exploratory and based on the experiences of mines that use this approach has special considerations to be taken into account.

4.9.1 Determined according to the methods of mining crusher sites

a) Extraction of stripping down

In this way, according to multiyear programs, certain parts of the mine will progress to the final of the next cuts will be determined by the end of the program. If such an extraction method, the crusher system minerals used in the site's location in the center of each cut or slightly lower than it would be and then cut with new cutting crusher to a new location in the center of the place Bearing conditions are balanced in every respect will be installed and will be looking to end this way.

- **Extracting the stripping Ascending**

  So no bridges to last years will not reach the final of stripping operations as well as ore mining will continue in all the steps and this is an issue. If the deposit for the mining crusher for crushing ore layer and system design because the volume of ore mined in deposits at the bottom of the mine and a few steps further layer close to it can dramatically crusher always kept mine floor and the depth changes also changed crusher location. But if the deposit mass, several steps are necessarily scattered deposits and mining operations should be performed in all of them. So if mining capacity is large, it is suggested that several mining crushers with a capacity of less that are deployed in different locations, if capacity is used and trace minerals or may not be available crusher mining equipment by some, it is suggested that the upper horizons of the lower horizons is transferred by a vertical wells Handling and operation of wells on the site crusher by belt conveyor is necessary.

- **Extracting the fixed stripping**

  This method will be tried for stripping the mining operations, based on the proportion of fixed and done. In this way the horizons of stairs higher to gradually reach their limit stops in their operations. So generally you must move the mine's crusher to the depth. To avoid the disadvantages of the two methods before, in practice, most mines use this method. In this way, after the period of preparation and extraction steps, crusher is installed below the center of gravity and calculated so that trucks do not have a lot of time waiting crusher and Saul and also in the crusher or in front of truck traffic work is done, different times of face transfer to the crusher. In the beginning crusher on fewer trucks will be required often and gradually with the development of mining in the wings and floors are bearing more and more tracks so we need to count. Usually this is done to add a few trucks and then transfer to the new site is examined crusher. The new site also features listed, you need to be close enough to the old site. Because the handling of the new site to an existing site, the rest of the site previous to out-of-mine transport is guaranteed. There is usually an inclined tunnel with a slope angle of 14-18 degrees in the mine for material handling necessary. There is no need to connect the conveyor to the previous site to site 2 is not inclined tunnel .Usually considered to be based on a number of other sites connected to it somehow.

- **Ways away from the center**

In this way a few small mines are considered for the entire mine. Mining in small mines are large mines 90-60 meters and 60-30 meters. Thus, in addition to mining, mine Method number one, in the rest of Mines and mining extraction operations conducted in-depth and spread attacks. To install the system in the mine crusher and conveyor should be noted in this extraction procedure that’s because large-scale mining operations is done from bottom to surface mining,

we can consider two methods for it. The first method is to choose a crusher with high capacity and transfer all the ingredients of face is by truck and vertical wells The second method is a choice of several mobile crushers with a capacity of less and deploy it in various Pit. What could be effective in two, Compare the total cost over the life of mine operating and capital that must take place during mine design and finish of the chosen one.

4.10 Locations -finding stone crusher inside the pit in Sarcheshmeh Copper Mine

This is done because the factors affecting the selection of the site are always in one direction and different places in terms of one of the other places are preferred. For this purpose, two methods of multi-criteria decision AHP and TOPSIS method that is used in many projects in the industrial and mining that are mentioned in the beginning of the season we use. To determine locations of the rock crusher mineral and gangue based on the location of evacuation mineral and mine tailings into four areas, including the North Mine, West mine, mine south and south-mining classified in this division Figure4-8 shows Packaging given. Then select the position crusher parameters mentioned above, then analyzed by two methods were continuing to examine them(Rahimdel and Karamoozian, 2014).

4.10.1 Locate the stone crusher inside the pit technique TOPSIS for waste

Multiple Attribute Decision Making matters, the index evaluates each option and select the desired level by establishing criteria or through comparisons of test criteria and options for you to be. The indicators are qualitative converted to a small number, and by comparing the index with each other, the importance and priority of each set and choose the better option.

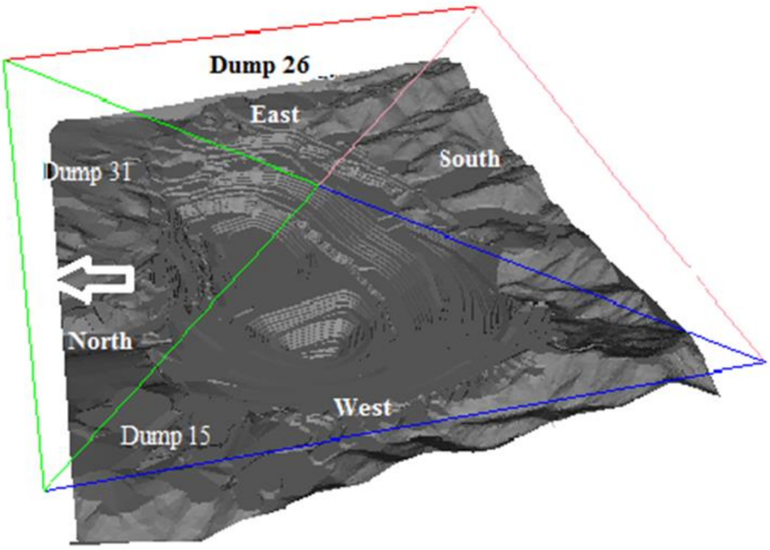

Figure 4.2: Division Sarcheshmeh copper mine in the mineral and waste discharge based on the location of the four areas.

4.10.2 Converts indexes of quality indicators slightly

Multiple Attribute Decision Making matters, the indexes also expressed quantitatively and qualitatively are. Indicators such as price, time, distance, cost, capacity, speed and index, but they are few indicators such as quality, convenience, aesthetics, flexibility and plasticity index of quality can be. Method to convert various indicators of quality indicators that are of little use scale interval of rank or scale dipole11 normally the most of this method can be. Methods bipolar scale an 11-point scale used to index with positive and negative aspects are presented in Table A.2 and A.3 in appendix.

The value of 2, 4, 6 and 8 the intermediary between two other values is. The value of 0 and 10 are less used to be. This type of measurement is performed with the following three assumptions:

- The distance between the values is the same. For example, the distance between the very low, low, high and very high is equal to the distance between.
- Rate is a ratio scale. For example, a score of 9 is three times higher than 3 points.
- C) The combined value of (addition, subtraction, multiplication and division) to index different is allowed.

In order to become a little quality index within the project, the positive or negative for each of the parameters that determine the location of the rock crusher was effective, it was found as well as the criteria to determine the weight given in Table A-4 in appendix.

To analyze each region for the establishment of stone crushers in TOPSIS mentioned at the beginning of the season. The formulation of relevant continuing refusal calculations, and operates as follows them. Also in appendix you can follow the Scoring parameters in different areas to check Sarcheshmeh Copper Mine Tailings, Table A-5.

4.10.3 Making decision matrix

The number of criteria and alternatives and evaluate all options for different criteria, decision matrix compose to table A-6 appendix

4.10.4 No scale matrix

At this step (A-7), we try to measure different dimensions become the criteria for no scale There are several methods,

4.10.5 Locate the stone crusher inside the pit technique TOPSIS for mineral

To analyze each region for the establishment of stone crushers in TOPSIS mentioned at the beginning of the season. The formulation of relevant continuing refusal calculations, and operates as follows them.

As mentioned in section 4-10. To determine the rock crusher mineral in Sarcheshmeh Copper Mine, mine is divided into four zones and each zone based on the scores assigned in each area is assessed parameters. 4-12 mentioned in the table A-8.

And before starting the calculation Table A-9 we make table for Scoring parameters for evaluation of minerals in different parts of the Sarcheshmeh Copper Mine**.**

After this step we need to make a new matrix for ore data table A-10.

And try to convert them to no scale matrix table A-11.

4.10.6 Locate the stone crusher inside the pit technique AHP for waste

As mentioned at the beginning of the season, when the action Analytic Hierarchy Process and multi-criteria decision-making with multiple choice or decision that inflicted competitor, can be used. Criteria to evaluate and determine the best area for rock crusher waste all qualitative, quantitative metric conversion using Table 4-3, which is given in Table 4-16 For the practical application of analytic hierarchy process involves four basic steps that continue to calculate and determine the location of the crusher is given.

4.10.6.1 The hierarchical graph

The first step in AHP is the problem of the hierarchy, usually in the order in which the objective, benchmark (if any sub-criteria) and options shown are. Of the hierarchy of decision, factors compared and evaluated competing alternatives in making the show the show. To evaluate and compare options in a project where the goal of the hierarchy, criteria, sub-criteria and alternatives (the same area are: Option 1 (North mine): Option 2 (West mine), option 3 (South mine) and option 4 (East mine)) plotted and is shown in Figure 4-9. It is noted that since all formulas related to each step of the method described at the beginning of the method is given. Bringing the formula for the calculation stage and refused to be.in figure A-2 you can see the AHP graph.

4.10.6.2 Calculate the weight of the elements in the Analytic Hierarchy Process

At this stage, the elements of each of the other elements in the higher forms of paired comparison

And paired comparison matrix of criteria based on allocating points to a number that is calculated by engineers.as you can follow each steps as we show that at table A-14

4.10.7 Locate the stone crusher inside the pit technique AHP for mineral

As mentioned at the beginning of the season, when the action decision analytic hierarchy process with multiple-choice or multi-criteria decision-making rival faces, can be used. Proposed criteria to evaluate and determine the best area for rock crusher minerals are all qualitative, quantitative metric conversion for the practical application of analytic hierarchy process involves four basic steps that continue to calculate and determine the location of the stone crusher is given.

4.10.7.1 The hierarchical graph

The first step in AHP is the problem of the hierarchy, usually in the order in which the objective, benchmark (if any sub-criteria) and options shown are. Of the hierarchy of decision, factors compared and evaluated competing alternatives in the decision show that. As in the localization of ore gangue crusher, to evaluate and compare options in mineral hierarchical graph where the objective, criteria, sub-criteria and alternatives (the same area are: Option 1 (North mine): Option 2 (West mine), option 3 (south mine) and option 4 (east mine) It is noted that since all formulas related to each step of the method described at the beginning of the method is given. Of the formula given in the calculations and refused to be, In Table A-15 AHP calculation for crusher.

5 CONCLUSION

First of all, we collect the data about each part of Sarcheshmeh Copper mine land. We visited all part of that land and try to find the best zone for build a new stone crusher with multi criteria decision making (MCDM) with two different methods that we already explain the methodology. Criteria based on calculation by engineers and discuss with different experts at that mine, they also estimate the weight of the criteria for mineral and dump site. Making the matrix for dump site and mineral site its part of those two different methods that we do already and after calculation we find the place for dump and mineral site.

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method for multiple criteria choice in a dump machine facility placement problem was assigned.Obtained from previous result the mining area in south were filled for new stone crusher machine, leading it to be excluded from optimal region. The problem was containing 21 factor.Since some of them were containing negative effect the calculation were performed separately.

For finding the place for stone crusher and our dump site we need to pass 7 steps

- Form a matrix
- Normalization
- Build weight matrix
- Define ideal and non-ideal alternative
- Calculate similarity for the worst condition
- Rank the result

The conclusion of calculation is alternative

Result for dump site: A1 (North area of mining)>A3 (South area of mining)>A4 (East are of mining)>A2 (West area of mining)

Table 5.1: finding dump site with TOPSIS

Alternative 1	C1*	0.73340248	BEST
Alternative 2	C2	0.167965932	4th
Alternative 3	C3	0.330342791	2nd
Alternative 4	C4	0.314153619	3rd

Result for mineral (ore) site shows us: A2 (West area of mining)>A3 (South area of mining)>A4 (East area of mining)>A1 (North area of mining)

Table 5.2: finding mineral site with TOPSIS

Alternative 1	C1	0.383909666
Alternative 2	C2*	0.702204626
Alternative 3	C3	0.613710831
Alternative 4	C4	0.508297258

-AHP is one of the frequently used multi criteria decision making methods. Through assignment of factors and carefully judged sub factors for the multi decision problem the alternatives the decision maker can achieve optimum alternative. It`s a method for solving complex decision making based on the alternatives and multi criteria ,as it names stated. It is also a process for developing a numerical score to rank each decision alternative based on how well each alternative meets the decision maker`s criteria.

In this method we need to do some steps:

Phase 1: Develop rating for each decision criteria

Step 1: Defining the decision problem

The weight for criteria for multiple choice system problems must be defined.

Step 2: The Pair-Wise comparison

Step 3: Synthesizing the Judgment

Step 4: Consistency Analyses for criteria

Phase 2: Develop the rating for each decision alternative for each criterion

Step 1: Defining the Decision Problem

Step 2: The Pair-Wise Comparison

Step 3: Synthesizing the Judgment

Phase 3: Develop rating for overall hierarchy

Step 1: Overall Priority vector

Step 2: Overall Consistency Ratio

You can also follow each step in this study,

The resultant weight, provide that :A3 (South area of mining)>A2(West area of mining) >A4(East area of mining) >A1(North area of mining) .

Table 5.3: for dump site with AHP

Final Weight	Area
0.208905639	A1
0.245189832	A2
0.357476263	A3*
0.209072494	A4

Table 5.4: for stone crusher with AHP

Final Weight	Area
0.338368767	A1
0.396314466	A2
0.651098676	A3*

0.464157784	A4

A3 (South area of mining)>A2(West area of mining) >A4(East area of mining) >A1(North area of mining) >A1.

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APPENDICES

Table A.1: Effective selection criteria factory for different people

12	11	10	9	8	7	6	5	4	3	2	1	Criteria
										●		**Amount of initial investment**
		●							●			**marketing**
							●					**Close to main road**
●		●		●			●		●		●	**Water supply**
		●		●			●				●	**Power supply**
		●									●	**Fuel supply**
●									●		●	**Providing the land**
●		●		●					●		●	**Transportation**
					●				●			**tax**
				●			●					**Airport**
		●					●		●	●		**Access to raw materials**
							●					**Close to railway**
				●						●		**The area of the construction site**
		●			●				●	●		**Access to labor**
					●			●				**Energy costs**
				●				●	●			**Weather**
			●					●	●			**water pollution**
			●					●	●			**air pollution**
				●				●				**Vegetation and animal species**

Table A.1: (continue) Effective selection criteria factory for different people

								●				**General Health**
			●	●								**Topography**
				●								**Type of soil**
				●								**Earthquake**
				●								**Fault**
				●								**Rivers and floods**
●				●								**natural sources**
	●		●					●				**Local laws**
			●									**Human settlements**
			●					●				**Training and Safety**
								●				**Occupation**
	●		●									**Social Factors**
	●											**Cultural Factors**
	●	●										**Political factors**
				●								historical monuments
				●								Population centers

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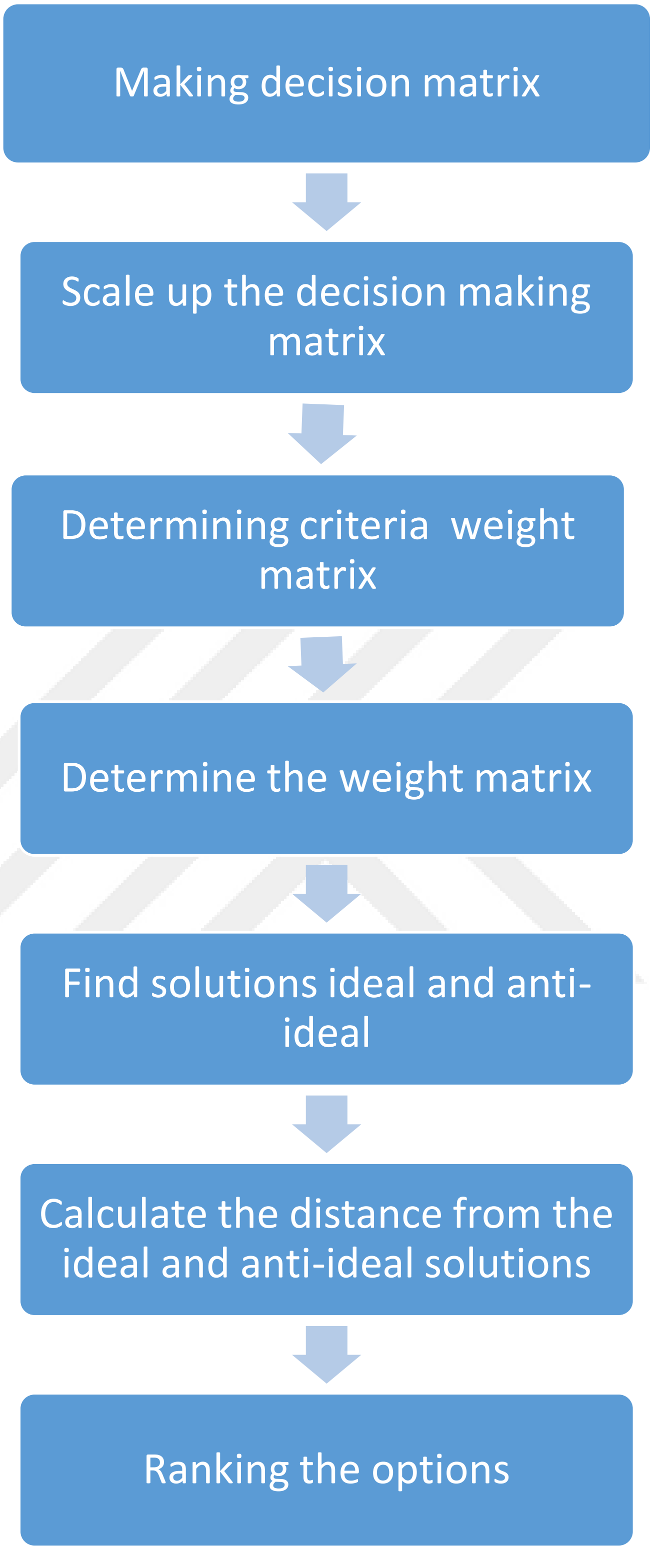

Figure A.1: Ideal method steps

Table A.2: Expression of qualitative positive indicator for a little bit

positive aspect	10	9	8	7	6	5	4	3	2	1	0
		too much		A lot		Strong		little		Very little	

Table A-3: Expression negative indicator for a little quality

Table A.3: Expression negative indicator for a little quality

negative aspect	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
		Very little		little		Strong		A lot		too much	

Table A.4: Expression of positive and negative factors and the effect of the weight of each parameter

Row	Factors	Positive or negative indicator	weight
1	Mine capacity	positive	0,25
2	Economic factors	negative	0,17
3	geotechnical	positive	0
4	transportation	negative	0,15
5	road and ramp	positive	0,04
6	topography	positive	0,05
7	Rock blasting	negative	0,05
8	energy	positive	0,05
9	Disturbance	negative	0,01
10	noise and dust	negative	0,01
11	stones crusher machine space requirement	positive	0,01

Table A.4: (continue) Expression of positive and negative factors and the effect of the weight of each parameter

12	safety	positive	0,01
13	mine shape and ore deposit pattern	positive	0,02
14	supplementary road	positive	0,01
15	location of stone crusher machine	positive	0,05
16	setup time of production line (stone crusher Machine)	negative	0,02
17	mine expansion (consistency and compatibility)	positive	0,04
18	waste water	negative	0,02
19	environmental effect	negative	0,01
20	distance front existing stone crusher	positive	0,02
21	maintenance and repair	negative	0,01
Total			1

Table A.5: Scoring parameters for evaluation in different parts of the Sarcheshmeh Copper Mine Tailings

Row	Factors	effective parameters	Mining division to four points			
			Near the waste dump			
			D31	D15	New dump	D26
			A1	A2	A3	A4
1	Economic	The volume of excavation, the lowest along the conveyor, the shortest distance shippers, The number of trucks	1	4	4	4
2	geotechnical	Joints, faults, gush ground, broke and unstable ground	5	3	5	5
3	transportation		1	5	5	6
4	distance		5	4	3	4
5	Road and Ramp		4	4	4	4
6	topography		7	1	5	6
7	Rock blasting		3	3	3	3
8	energy		9	5	9	9
9	Disturbance		5	5	9	5
10	Noise and dust		5	7	7	7
11	stones crusher machine space requirement		7	5	6	9
12	Safety		9	5	5	7
13	mine shape and ore deposit pattern		7	5	5	5
14	supplementary road		5	5	3	5
15	location of stone crusher machine		7	5	3	5
16	setup time of production line (stone crusher Machine)		3	3	5	5
17	mine expansion (consistency and compatibility)		5	5	5	5
18	Waste water		4	1	5	5
19	environmental effect		3	3	3	3
20	Mine capacity		5	5	7	7
21	maintenance and repair		4	4	7	7

Table A.6: Decision matrix for dump site TOPSIS

A1 D31	1	5	1	4	7	3	9	5	5	7	9	7	5	7	3	5	4	3	5	4	5
A2 D15	4	3	5	4	1	3	5	5	7	5	5	5	5	5	3	5	1	3	4	4	5
A3 new dump	4	5	5	4	5	3	9	9	7	6	5	5	3	3	5	5	5	3	3	7	7
A4 D26	4	5	6	4	6	3	9	5	7	9	7	5	5	5	5	5	5	3	4	7	7

Table A.7: No-Scale decision matrix for dump site TOPSIS

A1	0.14286	1	0.10721	1	0.6644	1	0.54976	0.40032	0	0.5065	0.67082	1	0.5455	0.6736	0.3638	1	0.4887	1	0.6155	0.35082	0.411
A2	0.57143	0	0.53606	1	0.0949	1	0.30542	0.40032	1	0.3618	0.37268	0	0.5455	0.4811	0.3638	1	0.1222	1	0.4924	0.35082	0.411
A3	0.57143	1	0.53606	1	0.4746	1	0.54976	0.72058	1	0.4341	0.37268	0	0.3273	0.2887	0.6063	1	0.6108	1	0.3693	0.61394	0.5754
A4	0.57143	1	0.64327	1	0.5695	1	0.54976	0.40032	1	0.6512	0.52175	0	0.5455	0.4811	0.6063	1	0.6108	1	0.4924	0.61394	0.5754

Table A.8: Build weight matrix

A1	0.02429	0	0.01608	0	0.0332	0	0.02749	0.004	0	0.0051	0.00671	0	0.0055	0.0337	0.0073	0	0.0098	0	0.0123	0.00351	0.10275
A2	0.09714	0	0.08041	0	0.0047	0	0.01527	0.004	0	0.0036	0.00373	0	0.0055	0.0241	0.0073	0	0.0024	0	0.0098	0.00351	0.10275
A3	0.09714	0	0.08041	0	0.0237	0	0.02749	0.00721	0	0.0043	0.00373	0	0.0033	0.0144	0.0121	0	0.0122	0	0.0074	0.00614	0.14385
A4	0.09714	0	0.09649	0	0.0285	0	0.02749	0.004	0	0.0065	0.00522	0	0.0055	0.0241	0.0121	0	0.0122	0	0.0098	0.00614	0.14385

Table A.9: IDEAL and NON-IDEAL

IDEAL	0	0	0	0	0	0	0	0	0	2E-06	0	0	0	0	0	0	5E-05	0	0	0	0.00169	0.042	S1*
	0.00531	0	0.00414	0	0.0008	0	0.00015	0	0	8E-06	8.9E-06	0	0	9E-05	0	0	0	0	6E-06	0	0.00169	0.111	S2*
	0.00531	0	0.00414	0	9E-05	0	0	1E-05	0	5E-06	8.9E-06	0	5E-06	0.0004	2E-05	0	1E-04	0	2E-05	6.9E-06	0	0.101	S3*
	0.00531	0	0.00647	0	2E-05	0	0	0	0	0	2.2E-06	0	0	9E-05	2E-05	0	1E-04	0	6E-06	6.9E-06	0	0.11	S4*
NON-IDEAL	0.00531	0	0.00647	0	0.0008	0	0.00015	1E-05	0	2E-06	8.9E-06	0	5E-06	0.0004	2E-05	0	6E-06	0	2E-05	6.9E-06	0	0.115	S1-
	0	0	0.00026	0	0	0	0	1E-05	0	0	0	0	5E-06	9E-05	2E-05	0	1E-04	0	6E-06	6.9E-06	0	0.022	S2-
	0	0	0.00026	0	0.0004	0	0.00015	0	0	5E-07	0	0	0	0	0	0	0	0	0	0	0.00169	0.05	S3-
	0	0	0	0	0.0006	0	0.00015	1E-05	0	8E-06	2.2E-06	0	5E-06	9E-05	0	0	0	0	6E-06	0	0.00169	0.05	S4-

Table A.10: Scoring parameters for evaluation of minerals in different parts of the mine

Row	Factors	effective parameters	Mining division to four points			
			Near the waste dump			
			D31	D15	New dump	D26
			A1	A2	A3	A4
1	Economic	The volume of excavation, the lowest along the conveyor, the shortest distance shippers,	9	5	3	5
		The number of trucks				
2	geotechnical	Joints, faults, gush ground, broke and unstable ground	5	3	5	5
3	transportation		9	5	3	5
4	distance		9	7	5	6
5	Road and Ramp		7	6	5	6
6	topography		7	5	5	5
7	Rock blasting		9	3	3	3
8	energy		3	5	9	9
9	Disturbance		9	5	9	5
10	Noise and dust		5	5	5	5
11	stones crusher machine space requirement		5	5	6	6
12	Safety		9	4	5	5
13	mine shape and ore deposit pattern		5	5	5	5
14	supplementary road		7	5	3	5
15	location of stone crusher machine		9	5	3	5
16	setup time of production line (stone crusher Machine)		7	5	5	6
17	mine expansion (consistency and compatibility)		5	4	3	3
18	Waste water		4	1	5	5
19	environmental effect		3	3	3	3
20	Mine capacity		9	9	5	5
21	maintenance and repair		7	5	5	5

Table A.11: Decision matrix for Ore site TOPSIS

A1	9	5	9	7	7	9	3	9	5	5	9	5	7	9	7	5	4	3	9	7	9
A2	5	3	5	6	5	3	5	5	5	5	4	5	5	5	5	4	1	3	7	5	9
A3	3	5	3	5	5	3	9	9	5	6	5	5	3	3	5	3	5	3	5	5	5
A4	5	5	5	6	5	3	9	5	5	6	5	5	5	5	6	3	5	3	6	5	5

Table A.12: No-Scale Decision matrix Ore site TOPSIS

A1	0.76064	1	0.76064	1	0.6286	1	0.21429	0.61812	1	0.4527	0.74231	1	0.6736	0.7606	0.6025	1	0.4887	1	0.6512	0.62862	0.61812
A2	0.42258	0	0.42258	0	0.449	0	0.35714	0.3434	1	0.4527	0.32991	1	0.4811	0.4226	0.4303	1	0.1222	1	0.5065	0.44901	0.61812
A3	0.25355	1	0.25355	0	0.449	0	0.64286	0.61812	1	0.5432	0.41239	1	0.2887	0.2535	0.4303	0	0.6108	1	0.3618	0.44901	0.3434
A4	0.42258	1	0.42258	0	0.449	0	0.64286	0.3434	1	0.5432	0.41239	1	0.4811	0.4226	0.5164	0	0.6108	1	0.4341	0.44901	0.3434

Table A.13: Build weight matrix

A1	0.12931	0	0.1141	0	0.0314	0	0.01071	0.00618	0	0.0045	0.00742	0	0.0067	0.038	0.012	0	0.0098	0	0.013	0.00629	0.15453
A2	0.07184	0	0.06339	0	0.0225	0	0.01786	0.00343	0	0.0045	0.0033	0	0.0048	0.0211	0.0086	0	0.0024	0	0.0101	0.00449	0.15453
A3	0.0431	0	0.03803	0	0.0225	0	0.03214	0.00618	0	0.0054	0.00412	0	0.0029	0.0127	0.0086	0	0.0122	0	0.0072	0.00449	0.08585
A4	0.07184	0	0.06339	0	0.0225	0	0.03214	0.00343	0	0.0054	0.00412	0	0.0048	0.0211	0.0103	0	0.0122	0	0.0087	0.00449	0.08585

Table A.14: IDEAL and NON-IDEAL

IDEAL	0.00743	0	0.00579	0	0	0	0.00046	7.5E-06	0	8E-07	0	0	0	0	1E-05	0	5E-05	0	0	3.2E-06	0	0.121	S1*
	0.00083	0	0.00064	0	8E-05	0	0.0002	0	0	8E-07	1.7E-05	0	4E-06	0.0003	0	0	0	0	8E-06	0	0	0.046	S2*
	0	0	0	0	8E-05	0	0	7.5E-06	0	0	1.1E-05	0	1E-05	0.0006	0	0	1E-04	0	3E-05	0	0.00472	0.076	S3*
	0.00083	0	0.00064	0	8E-05	0	0	0	0	0	1.1E-05	0	4E-06	0.0003	3E-06	0	1E-04	0	2E-05	0	0.00472	0.082	S4*
NON-IDEAL	0	0	0	0	8E-05	0	0	0	0	0	1.7E-05	0	1E-05	0.0006	0	0	6E-06	0	3E-05	0	0.00472	0.075	S1-
	0.0033	0	0.00257	0	0	0	5.1E-05	7.5E-06	0	0	0	0	4E-06	7E-05	1E-05	0	1E-04	0	8E-06	3.2E-06	0.00472	0.108	S2-
	0.00743	0	0.00579	0	0	0	0.00046	0	0	8E-07	6.8E-07	0	0	0	1E-05	0	0	0	0	3.2E-06	0	0.121	S3-
	0.0033	0	0.00257	0	0	0	0.00046	7.5E-06	0	8E-07	6.8E-07	0	4E-06	7E-05	3E-06	0	0	0	2E-06	3.2E-06	0	0.085	S4-

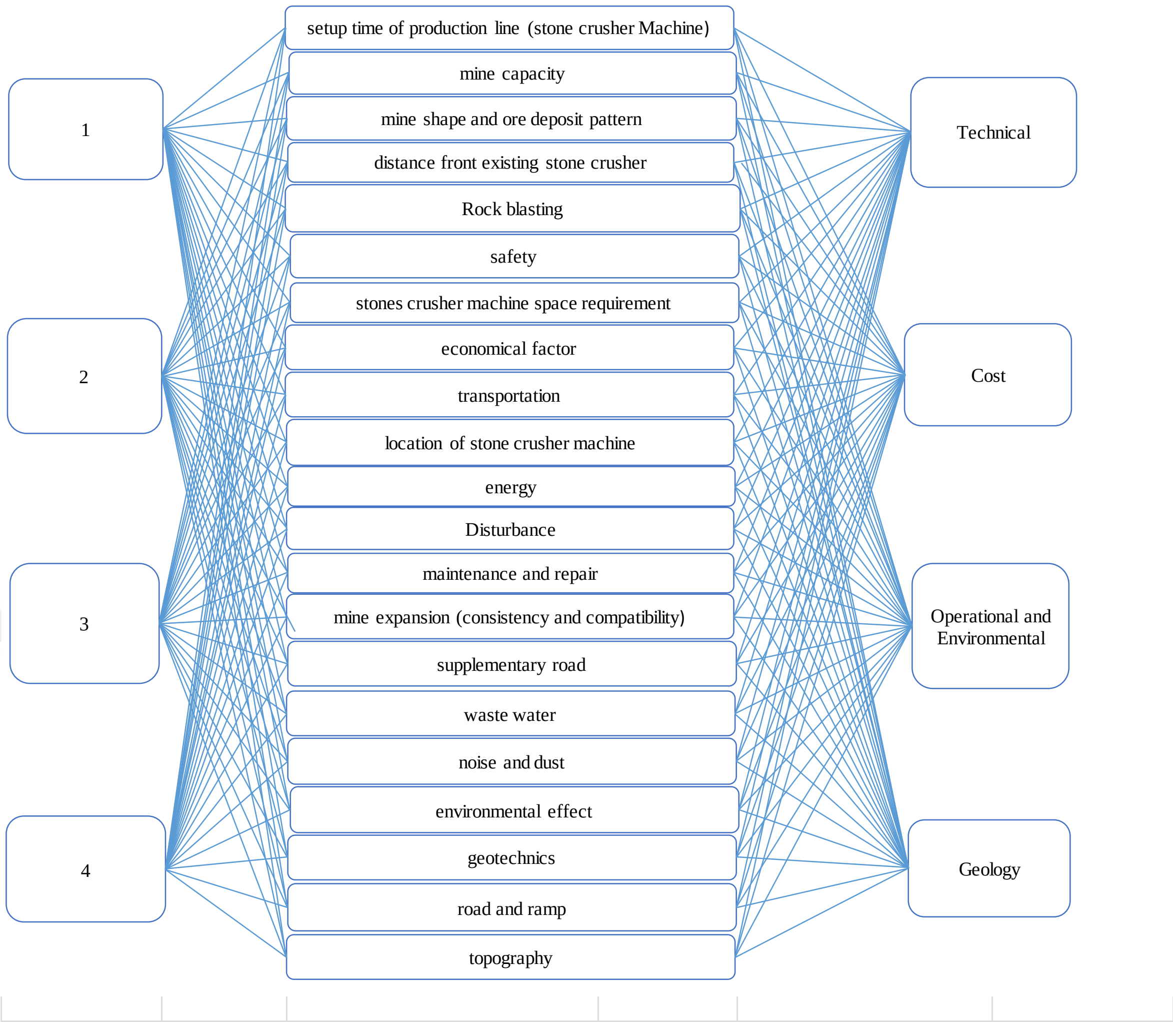

Figure A.2: Locate a hierarchical graph rock crusher in Sarcheshmeh Copper Mine Tailings

Table A.15: Inventory assigned numerical scores for each of the following criteria for the formation of pair-wise comparison matrix between standards

Expert 1	Expert 2	Expert 3	Expert 4	**Average**
5	7	3	5	**5**
5	9	7	9	**7.5**
3	1	7	5	**4**
7	9	7	9	**8**
3	9	5	3	**5**
5	1	5	5	**4**
5	1	9	7	**5.5**
5	9	3	9	**6.5**
5	5	7	9	**6.5**
5	1	9	7	**5.5**
5	1	3	1	**2.5**
3	1	7	1	**3**
5	1	5	7	**4.5**
5	3	9	5	**5.5**
5	1	5	1	**3**
7	1	3	1	**3**
5	1	3	1	**2.5**
5	1	5	1	**3**
5	1	5	7	**4.5**
5	3	7	9	**6**
7	3	5	9	**6**

Table A.16: the importance of each of the following criteria

	Factor Effect	factor code	Factor name
Technical	-1	C1	setup time of production line (stone crusher Machine)
	1	C2	mine capacity
	1	C3	mine shape and ore deposit pattern
	1	C4	distance front existing stone crusher
	-1	C5	Rock blasting
	1	C6	safety
	1	C7	stones crusher machine space requirement
Cost	-1	C8	economical factor
	-1	C9	transportation
	1	C10	location of stone crusher machine
	1	C11	energy
Operational and Environmental	-1	C12	Disturbance
	-1	C13	maintenance and repair
	1	C14	mine expansion (consistency and compatibility)
	1	C15	supplementary road
	-1	C16	waste water
	-1	C17	noise and dust
	-1	C18	environmental effect
Geology	1	C19	geotechnics
	1	C20	road and ramp
	-1	C21	topography

Table A.15: Calculation of AHP for stone crusher

Expert 1	Expert 2	Expert 3	Expert 4	**Average**
9	5	3	9	**6.5**
9	5	5	9	**7**
3	1	5	3	**3**
5	5	7	5	**5.5**
3	5	7	3	**4.5**
5	1	5	3	**3.5**
5	1	9	5	**5**
5	5	3	5	**4.5**
5	3	7	5	**5**
3	1	9	7	**5**
5	1	3	1	**2.5**
3	1	7	3	**3.5**
9	1	5	7	**5.5**
7	3	9	5	**6**
5	1	7	1	**3.5**
1	1	5	1	**2**
1	1	5	1	**2**
1	1	3	1	**1.5**
1	1	3	1	**1.5**
1	3	7	5	**4**
1	3	7	5	**4**

RESUME

Ali Bakhshian

Beşyol Mah. Cami sk No: 20\1 Republika dormitory.

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Born 12 April 1993 in Iran

Education

10/2012 – 02/2015 **Islamic Azad University Shahrood**

Iran

Bachelor (B.Sc.) in Industrial Engineering

Focus: Facility Location & decision making

09/2015 Istanbul AYDIN University
Turkey

Master of Business Administration (MBA)

Professional Experience

04/2010 – 03/2015 **Reza stone factory** Iran

- **Production Supervisor**
- **Marketing**
- **R & D in production line**

02/2015 – 09/2015 **Arghavan Food Production Company** **Iran**

- Production Supervisor
- Responsible for purchasing

CBM & Shamim company

- Marketing and responsible for purchasing

Language skills

English: *Fluent verbal and written*

- *MSRT – Test : 47 score (24 /04 /2015)*
- Certificate in Advanced English (03/2008)

Persian: *Native language*

Turkish: *Primary*

Technical skills

Proficient user of: Microsoft Windows (XP, Vista, 7, 8, 10)

Microsoft Office Word, Excel, PowerPoint, Access,photoshop

Social skills and awards

- President of the „ Student Association" at the Azad University
- Top student for two years, 2013 -2015
- B.Sc. thesis about the facility location in the Sarcheshmeh copper mine, 2015
- various designs of modern technology in the automobile factory , 2010-2014
- facility location in automobile production line , 2014
- facility location about stock explosives in mine, 2014-2015
- Different techniques of decision (TOP SIS- AHP and, etc.), 2013
- 1st place in the Robotic war in the Guidance school , 2009
- 1st place in the Khwarizmi festival about pharmacy , 2011

Recommendation

- *Ph.D. Mohammad Taji* *taji@ymail.com*
- *Ph.D. Mohammad Mohammadiun* *Mmohammadiun@yahoo.com*
- *Ph.D. Nima Mirzaei* *nimamirzaei@aydin.edu.tr*