



## COMPILING THE STRATEGIES OF ALFA MINING COMPANY AND PRIORITIZING THEM BY WASPAS METHOD

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**ABSTRACT. Background:** Nowadays mining companies, as non-profit organizations like other organizations, face a complex and turbulent environment. The proper guidance of the organizations depends on understanding the internal and external environment and making smart strategic decisions. Therefore, to deal effectively with all the factors that affect the ability of the company in its profitable growth, because organizations need compiling strategic planning to increase their capabilities, long-term growth and survival and to reduce operational risk, organizations have turned to strategic planning in particular. After compiling strategies, determining the priority of strategies is very important. The statistical population of this research has consisted of 50 heads of operational and support affairs units [to determine internal factors] along with 10 managers and deputies [to determine external factors]. In this research, strategies were first identified via the Strengths, Weaknesses, Opportunities, and Threats [SWOT] matrix and then ranked by the Weighted Aggregates Sum Product Assessment [WASPAS] method.

**Materials and methods:** In addition to the QSPM approach, multi-indicator decision-making models can also be used to prioritize strategies. Nowadays, as multi-indicator decision-making related topics are intensified and on the other hand, the increasing tendency towards interdisciplinary sciences and the use of theories of various groups and specialties in solving complex problems, the necessity to pay attention to decision-making analysis techniques and exploiting them in solving existing complex problems is of great importance. In these models, selecting one option among the available options is considered. In a general definition, multi-indicator decision making refers to specific [preferential type] decisions, such as evaluating, prioritizing, or selecting among the available options [which sometimes should be done among several contrasting indicators]. Some multi-indicator decision-making models are: AHP, ANP, ELECTRE, VICTOR, TOPSIS, SAW, GRA, SIR, PROMETHEE and WASPAS. In this article, the WASPAS method has been used to determine the prioritization of strategies.

**Results:** In this research, strategies were first identified via the Strengths, Weaknesses, Opportunities, and Threats [SWOT] matrix and then ranked by the Weighted Aggregates Sum Product Assessment [WASPAS] method. Ultimately, the strategies of "assigning a part of the sale to individuals or qualified private companies", "creating the Technology Transfer Office [TTO] in order to move towards self-sufficiency", and "comprehensive planning in the field of human resources in order to create an effective and efficient culture" were selected as strategic priorities for the Alpha Mining Company.

**Conclusions:** Various approaches have already been proposed to prioritize strategies; in this research, the criteria have been specified using the ACCEPT approach and finally by the WASPAS method, the strategies have been prioritized. The ACCEPT method unlike the QSPM method, which prioritized strategies by taking into account strengths and weaknesses, opportunities and threats, regardless of environmental conditions and existing organizational status and externally by considering 6 main parameters of strategy evaluation including cost, time, popularity, effective, and so on, helps to prioritize strategies. In this research, it was tried to use one of the techniques of MADM according to relevant and important criteria to enhance the assurance coefficient of managers' decision making. Multi-criteria decision-making techniques have this advantage that they evaluate various options according to various criteria that do not have equal units. Another important advantage of multi-criteria decision-making techniques is that they are capable of analyzing quantitative and qualitative criteria simultaneously.

**Key words:** SWOT Matrix, Strategic Planning, WASPAS, ACCEPT.

## INTRODUCTION

Nowadays, strategic planning, as one of the most efficient management approaches in organizations, has been considered by experts and planners. In today's complex and varied world, strategic planning and management is a way to help organizations and communities to face with rapid environmental changes. In fact, comprehensive planning is an effective measure against the competitive and changing world because it considers the internal and external facilities and constraints of the organization and makes its forecasts according to them. Strategic planning is a structured effort to take fundamental decisions and to perform actions that shape and enable the nature of the organization, the type of activities, and the reasons for doing those activities by the organization. In general, strategic planning provides this possibility for the organization to know where it will go in the next one to three years and how it can get there [Movahedi et al., 2012]. Strategic planning has always been promising transformation and success since its inception in the 1960s to the present. During this period, prominent thinkers and philosophers have developed the concepts and foundations of this field; and as a result of their efforts, the concepts and tools of strategic planning have greatly been evolved. By analyzing an organization's capabilities, weaknesses, opportunities, and threats, factors that may affect the future outcomes of the organization or institution are identified. The patterns of capabilities, weaknesses, opportunities, and threats to identify the unique competencies of the organization are considered as the fundamental factors of the success of the organization, and the purpose of analyzing these factors is to provide strategies that guarantee a balance between the external environment and the internal status [Lerner, 1999].

Managers are turning to strategic planning in order to deal effectively with all the factors that affect the company's ability in its profitable growth. Many quantitative tools and techniques have already been used in the field

of strategic management, that since the major component in this field is decision-making regarding the concurrent multiple considerations, so multi-criteria decision-making techniques have allocated the highest ratio of use to themselves. In this respect SWOT analysis is one of the tools used in the strategy compilation stage to analyze internal and external strategic cases that can summarize the most important internal and external factors that can influence an organization's future. This matrix is one of the important tools whereby the managers compare information and using it can present four types of strategies: SO or offensive strategies, WO or conservative strategies, ST or competitive strategies, and WT or defensive strategies [David, 2009]. In fact, strategic planning is the process of determining the organization goals and taking a decision about comprehensive operational and executive plans to realize those goals. Strategic planning in organizations typically includes the stages such as: assessing the current environment, defining the mission of the organization, determining the organization's vision, recognizing the capabilities, weaknesses, opportunities, and threats of the organization and planning to move the organization or institution from current situation to desirable status periodically [Policastro, 2000].

SWOT analysis is to find a strategy or strategic balance between opportunities [external] and strengths [internal] with respect to threats [external] and weaknesses [internal], in order to remove them; the following factors summarize the strategic factors of a company: Strengths, Weaknesses, Opportunities, and Threats [Arabi, Parsaian, 2019]. The first step in the strategic planning is to determine the mission, goals, and assignments of the organization, then, a strategy can be designed for the organization that is appropriate to its environment through SWOT analysis, that is one of the strategy compilation tools [Pierce and Robinson, 2000]. This matrix shows how to create a balance between external and internal factors. In fact, by shaping a quadratic matrix, it compiles four different types of strategies depending on a pair of internal and external factors [Hanger, Violin 2002].

Generally, this matrix links internal and external factors together and uses it as a basis for possible strategies [Movahedi et al., 2012]. In the Alpha Mining Company, considered as the case study in this research, it can be hoped that strategic planning, by determining the strategic and overall goals of the organization is identified, and by the optimized use of organizational resources enhances the objectives. Strategic planning will lead to the

recognition of the strategic position of the organization, the identification of strategies and the selection of proper strategies based on priorities. Therefore, the main purpose of this research is to compile strategies and prioritize them by the WASPAS method for the Alpha Mining Company. In Table 1 some of the important conducted domestic and foreign researches have been presented.

Table 1. Previous Domestic and Foreign Researches

Research Title	Year	Authors
Exploring competitive priorities in the service sector: evidence from India	2019	Idris, F. and Naqshbandi, M.M.
Using the ANP Method to Prioritize Rural Development Strategies with the LEADER Approach in Protected Areas	2019	Fernandez Portillo et al.
Selection of effective risk mitigation strategies in container shipping operations	2019	Chang, C.H., Xu, J., Dong, J. and Yang, Z.
Prioritizing E-Government Strategies Using the Ranked Voting of SWOT Analysis Technique: Case study: Jordan	2017	Yousef Elsheikh, Mohammad Azzeh
Prioritizing Strategies in EMS Systems	2017	Bandara et al.
Application of TOPSIS and Fuzzy Intuitive Set Approaches to Rank Lifecycle Sustainability Efficiency in Alternative Vehicles Technology	2016	Onat et al.
Hydrogen Economy In China: Strengths, Weaknesses, Opportunities, and Threats Analysis and Prioritizing Strategies; Scipers	2015	Ren et al.
Environmental and Social Sustainability Priorities: Integrating Them into Operational Strategies	2015	Annachiara Longoni, Raffaella Cagliano
Prioritizing Stakeholders, Corporate Strategic Social Responsibility and Corporate Performance: Further Evidences	2014	Giacomo Boesso, Francesco Favotto, Giovanna Michelon
Direct shipping across the Taiwan strait: flag selections and policy issues	2013	Yang, S.H. and Chung, C.C.
Operations strategy and business strategy alignment model (case of Iranian industries)	2013	Khalili Shavarini, S., Salimian, H., Nazemi, J. and Alborzi, M.

By examining the above research, and by examining the research literature, it is possible to clearly accept the use of the QSPM method as the dominant and superior method for prioritizing strategies. But using this method, like other MCDM methods, has its drawbacks. For example, in the QSPM method, when weighing strategies according to SWOTs, the quality of the results can be reduced by the accuracy of the experts due to the multiplicity of SWOTs. On the other hand, in this method, only strategies based on SWOTs are prioritized. While other factors of strategy prioritization, including factors: cost, time, complexity, etc. are not considered. Therefore, in this study, one of the new methods of MCDM called WASPAS for prioritization of strategies has been studied.

## RESEARCH METHODOLOGY

The orientation of this research is among applied researches as it is used for all large companies that it is in respect of applying its results to solve the problem ahead, namely compiling strategies along with prioritizing them. The present research is done by the inductive approach. In a way that, in investigating the existing research literature and models, the identification of the internal and external factors classes has been done by the inductive approach of the previous models, that are referred below. This research is qualitative in respect of type. Therefore, in the first stage of the research, by the qualitative research method such as meeting, interview and completing forms by internal and external experts, it is necessary to specify external and internal factors. In conducting this research to compile the strategies of the Alpha Mining

Company using SWOT, at first the strengths and weaknesses of the company were determined by interviewing with the heads of affairs and then the threats and opportunities were extracted by interviewing the manager and the deputies. Then, in the article, the heads of units are called internal experts, and the managers and deputies of the company are called external experts. The internal and external factors are identified in a single internal form by internal experts and in a single external form by external experts of the company, and those factors were scored and the internal and external factors evaluation matrix was prepared. The SWOT matrix was then drawn and with the help of this matrix, appropriate strategies for the Alpha Mining Company were obtained. The criteria of the ACCEPT method were used as the criteria of the WASPAS method. The criteria were weighted using the Shannon Entropy method. Finally, prioritizing the selected strategies was done using the Weighted Aggregates Sum Product Assessment [WASPAS] method. The statistical population of this research has been 60 persons including 50 heads of operational and support units [for determining internal factors] along with 10 managers and deputies [for determining external factors].

### Methods for Prioritizing Strategies

In addition to the QSPM approach, multi-indicator decision-making models can also be used to prioritize strategies. Nowadays, as multi-indicator decision-making related topics are intensified and on the other hand, the increasing tendency towards interdisciplinary sciences and the use of theories of various groups and specialties in solving complex problems, the necessity to pay attention to decision-making analysis techniques and exploiting them in solving existing complex problems is of great importance [Moradi, Akhtarkavan, 2009]. In these models, selecting one option among the available options is considered. In a general definition, multi-indicator decision making refers to specific [preferential type] decisions, such as evaluating, prioritizing, or selecting among the available options [which sometimes should be done among several contrasting indicators]. Some multi-indicator decision-making models

are: AHP (Analytic Hierarchy Process), ANP (Analytic Network Process), ELECTRE (Elimination et Choice in Translating to Reality), VICTOR (VIsekriterijumsko Kompromisno Rangiranje), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), SAW (Simple Additive Weighted), GRA (Grey Relational Analysis), SIR (Superiority and Inferiority Ranking), PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluations), WASPAS.

In this article, the WASPAS method has been used to determine the prioritization of strategies.

### Weighted Aggregates Sum Product Assessment [WASPAS] Method

The world around us is full of multi-criteria decision-making issues, and humans are always forced to make decisions in these areas; macro decision makings in which various goals are pursued and we wish these goals to be optimal. In some cases, the decision-making result is so important that the emergence of error may impose irreparable losses, hence using the proper method for optimal selection and accurate decision-making is essential.

WASPAS is one of the new decision-making techniques. This model was introduced by Zavadskas in 2012, and it is recognized as one of the MCDM methods. This method is a combination of the Weighted Sum Model [WSM] and the Weighted Product Model [WPM]. Each MCDM problem starts with a decision matrix, in which  $m$  is the number of candidate options and  $n$  is the number of evaluation indicators.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix}$$

At this stage, regarding the index type [positive or negative] the following formulas [linear soft] are used for normalization:

For positive and negative indices the following formulas are used:

$$[\text{Positive index}] \quad \bar{x}_{ij} = \frac{x_{ij}}{\text{Max}_i x_{ij}} \quad [1]$$

$$[\text{Negative index}] \quad \bar{x}_{ij} = \frac{\text{Min}_i x_{ij}}{x_{ij}} \quad [2]$$

In the WASPAS method, a common optimization index based on the two optimization indices is used. The first optimization index like weight success mean is similar to the WSM method. Based on the WSM method, the relative importance of the whole option-i is calculated according to the following formula:

$$Q_i^{[1]} = \sum_{j=1}^n \bar{x}_{ij} w_j \quad [3]$$

On the other hand, according to the WPM method, the relative importance of the whole option i is calculated based on the following formula:

$$Q_i^{[2]} = \prod_{j=1}^n [\bar{x}_{ij}]^{w_j} \quad [4]$$

In which  $w_j$  is the relative importance of the index j.

The common index created by the integration of weighting mass and multiplication methods is suggested as follows:

$$Q_i = 0.5Q_i^{[1]} + 0.5Q_i^{[2]} = 0.5[\sum_{j=1}^n \bar{x}_{ij} w_j + \prod_{j=1}^n [\bar{x}_{ij}]^{w_j}] \quad [5]$$

In order to increase the accuracy and effectiveness of the decision-making process in the WASPAS method, a general equation to determine the relative importance of the whole option i has been expanded as follows:

$$Q_i = \lambda Q_i^{[1]} + (1 - \lambda) Q_i^{[2]} = \lambda \sum_{j=1}^n \bar{x}_{ij} w_j + (1 - \lambda) \prod_{j=1}^n [\bar{x}_{ij}]^{w_j} ; \lambda = 0, 0.1, \dots, 1 \quad [6]$$

When the value of  $\lambda$  is zero, the WASPAS technique will be converted to the WPM technique, and when it is equal to 1, we will have the WSM technique. If there is no particular idea for  $\lambda$ ,  $\lambda = 0.5$  will be considered. In this article based on  $\lambda = 0.5$ , the corresponding calculations have been performed.

## Shannon Entropy Weighting Method

The Entropy method is one of the multi-criteria decision-making methods for calculating the weight of the criteria. In this method, the criteria-option matrix is required. This method was proposed by Shannon and Weaver in 1974. The Entropy expresses the value of uncertainty in a continuous probability distribution. The main idea of this method is that the higher the dispersion in the values of an index is, that index has more importance. Shannon showed that events with a high probability of occurrence provide less information, and on the contrary, the lower the occurrence probability of an event is, the information obtained from it will be higher. By acquiring new information, uncertainties actually decrease and the value of new information equals the value that has been reduced from uncertainty. Consequently, uncertainty and information are interdependent parameters. Entropy is a very important concept in the social, physical sciences and information theory. The idea of the above method is that the higher the dispersion in the values of an index is, that index is more important [Soleimani Damaneh et al., 2011]. Entropy in information theory is a criterion of uncertainty expressed by the specified probability distribution. Shannon entropy method has been used in this article to weight the criteria. Entropy in information theory is a criterion of uncertainty expressed by the specified probability distribution  $P_i$ . Measurement of this uncertainty  $[E_i]$  by Shannon has been expressed as follows:

$$E_i = S(P_1, P_2, \dots, P_n) = -k \sum_{i=1}^n [P_i - \ln p_i] \quad [7]$$

$k$  is a constant value and is applied in the order that the  $E_i$  is between zero and one.  $E$  is calculated from the probability distribution of  $P_i$  based on the statistical mechanism, and its value in case of equality of  $P_i$  with each other [that is  $P_i = \frac{1}{n}$ ], will be the maximum possible value that is calculated as follows:

$$-k \sum_{i=1}^n P_i - \ln P_i = -k \left\{ \frac{1}{n} \ln \frac{1}{n} + \frac{1}{n} \ln \frac{1}{n} + \dots + \frac{1}{n} \ln \frac{1}{n} \right\} = -k \left\{ \ln \frac{1}{n} \left( \frac{n}{n} \right) \right\} = -k \times \ln \frac{1}{n} \quad [8]$$



k as a constant value is calculated as follows:

$$k = \frac{1}{Ln(m)} \quad [9]$$

The "Decision-Making Matrix" contains information that entropy can be used as a criterion for evaluating it. Suppose that the decision making-matrix is as follows.

Table 2. Decision-Making Matrix

Index Options	C <sub>1</sub>	C <sub>2</sub>	.....	C <sub>n</sub>
N <sub>1</sub>	a <sub>11</sub>	a <sub>21</sub>	....	a <sub>1n</sub>
N <sub>2</sub>	a <sub>21</sub>	a <sub>22</sub>	....	a <sub>2n</sub>
...	...	...	...	...
N <sub>m</sub>	a <sub>m1</sub>	a <sub>m2</sub>		a <sub>mn</sub>
W <sub>j</sub>	W <sub>1</sub>	W <sub>2</sub>	.....	W <sub>n</sub>

Using this matrix, P<sub>ij</sub> is calculated as follows:

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^m a_{ij}} ; \forall_{i,j} \quad [10]$$

And the Entropy of the j-index [E<sub>j</sub>] is calculated as follows:

$$E_j = -k \sum_{i=1}^m [P_{ij} Ln P_{ij}] ; \forall_j \quad [11]$$

The uncertainty or degree of deviation [d<sub>j</sub>] from the information obtained for the index j indicates how much useful information the relevant index [j] provides to the decision-maker for decision-making. The value [d<sub>j</sub>] is obtained as follows:

$$d_j = 1 - E_j ; \forall_j \quad [12]$$

Then the weight value w<sub>j</sub> is obtained as follows:

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j} ; \forall_j \quad [13]$$

## RESEARCH FINDINGS

In this section, the research findings and results have been investigated briefly. Since the main purpose of this research is to prioritize strategies and compare prioritization methods; therefore, in order to avoid content prolongation, no description of strategic planning is stated and only the SWOT matrix has been presented and then the priority of using strategies by the WASPAS technique has been specified.

### Matrix of Strengths and Weaknesses, Opportunities and Threats of the Alpha Mining Company

To prepare the SWOT matrix, the strengths, weaknesses, opportunities, and threats of the company should be mentioned in the SWOT matrix houses, and then by comparing these factors with each other, the strategies of WT, ST, WO, SO should be stated.

#### First Step: Identifying Internal Factors by Internal Experts

For a detailed analysis of SWOT, the raw form of strength and weakness was sent to the head of affairs [Internal Experts] of the Alpha Mining Company. The heads of affairs include middle managers of the company who have an acceptable dominance on internal organizational issues. To prevent the dispersion of opinions, the raw form is set into eight categories of "Manpower", "Equipments", "Management System", "Information Flow", "Goals", "Values and Beliefs", "Access to Resources" and "Structure and Organization" regarding various strategy models, such as the "Pigels & Roger" and "Branson & Freeman" strategy models as well as regarding the subject literature.

Having collected the completed forms of the weaknesses of affairs, they were also carefully investigated. The irrelevant, unimportant, and repeated cases were eliminated. The results, obtained from integration and refinement of the forms of weaknesses related to the affairs, have been presented in Table 4.

Table 3. Aggregated Table of Strengths Derived from Internal Experts' Viewpoint

Class	Dimensions to be Investigated	Strengths-S
1.	Manpower	1. High level of education [S1] 2. Having high experiences [S2] 3. Trainable forces [S3]
2.	Equipment	4. Reparability of previously installed pieces of equipment [S4]
3.	Information Flow	5. Simplicity and ease of using automation [S5] 6. Appropriate and Acceptable Access to Information [S6]
4.	Management	7. Using knowledge specialists to remove process defects [S7] 8. Holding Seminar Meetings [S8]
5.	Status of Goals	9. Continuous monitoring of purposes [S9]
6.	Values and Beliefs	10. Ability to do seemingly impossible works [S10]
7.	Access to Resources	11. Possibility of using laboratories outside the company for doing analyses [S11] 12. Access to abundant financial resources [S12]
8.	Structure and Organization	13. Existence of research units per production unit [S13]

Table 4. Weaknesses Taken from Internal Experts' Viewpoint

Class	Dimensions to Be Investigated	Weaknesses-W
1.	Manpower	1. Lack of proper planning for the allocation of forces [W1] 2. Lack of sufficient motivation and commitment [W2] 3. Lack of repair force in the mine [W3] 4. Existence of high expectations [W4] 5. Merely native selection [W5] 6. Existence of discrimination in a promotion [W6]
2.	Equipment	7. High energy consumption due to outdated technology [W7] 8. The burnout of the major part of loading and road construction machines and high cost of repairs [W8] 9. Lack of access to technologies tailored to the needs ahead [W9]
3.	Information Flow	10. Elimination of people's knowledge and experience after retirement [W10]
4.	Management	11. Management instability [W11] 12. Lack of meritocracy outlook [W12] 13. Insufficient motivational mechanisms and systems [W13]
5.	Status of Goals	14. Ignoring realities in compiling the goals [W14] 15. Involvement of other units in contradiction with the realization of the goals [W15]
6.	Values and Beliefs	16. Preference of personal interests over the corporation ones [W16]
7.	Access to Resources	17. Existence of a great deal of slowdown in the preparation of parts [W17]
8.	Structure and Organization	18. Mismatch of the description of duties with the position of individuals [W18]
9.	Others	19. Reduction of sales unit efficiency under sanction conditions [W19]

### *Second Step: Identifying External Factors by External Experts*

In order to analyze the external factors [threat and opportunity] with regard to its nature, it was tried to use relevant and informed individuals in its investigation. Therefore, senior managers of the company, including managers and deputies [external

experts], were used to complete the external factors forms. The PESTLE model and 5 Porter's competitive forces were used to explain the dimensions of external factors. The PESTEL model is investigated to describe the macro-environmental factors affecting a business. As a part of the strategic analysis technique, the PESTEL model is used in various sectors [Yoksel, 2012]. This model can

be used to understand the macro image of the environment of businesses, industries, and countries. The components of this model include political, economic, social, technological, environmental, and legal factors. Porter's Competitive Forces, known as the Five Competitive Forces, have been proposed by Michael Porter [1947] and include suppliers, customers, alternative products, competitors in the industry, and potential competitors. Using these two models and investigating the subject literature in relation to external factors, 11 categories related to external factors can be used to fully cover external factors. These 11 categories include "Economy and Politics", "Cultural and Social",

"Laws and Regulations", "Environment", "Technology", "Physical", "Suppliers", "Customers", "Alternative Products", "Competitors in the Industry" and "Potential Competitors". In Table 5 the identified threats obtained from collecting external experts' opinions have been presented.

The completed forms of opportunities were also carefully investigated after being collected. Irrelevant, unimportant, and repeated cases were eliminated. The results, obtained from the integration and refinement of the relevant forms have been presented in Table 6.

Table 5. Identified Threats from Collecting External Experts' Opinions

Class	Dimensions to Be Investigated	Threats-T
1.	Economic and Political Area	1. Emergence of many problems in the field of money transfer [T1] 2. The instability of the country's political and economic conditions [T2]
2.	Cultural and Social Areas	3. High unemployment rate in the adjacent areas of the factory [T3] 4. Exit of elite and capable forces from the country [T4]
3.	Area of Existing Laws and Regulations	5. Increasing the stringency of governmental organizations in the field of licenses [Natural Resources, Environment, Industries, and Mines Organization, and so on] [T5] 6. Bureaucracy and redundant rules for the clearance of required products and equipment [T6]
4.	Environmental Areas Such as Water, Air, Energy	7. The existence of a water crisis in the country and the continuation of droughts, thereby the possibility of the reduction of available water resources of the company in the future [T7] 8. Existence of pollutions despite establishing an acid factory due to the lack of continuity in acid production [T8]
5.	Technological Area	9. Unable to keep up with modern technologies due to the sanctions [T9] 10. Transferring technology incompletely [T10]
6.	Physical Area Such as Geography	11. Reduction of cutie in mines [T11]
7.	In the Area of Suppliers	12. Existence of some unique manufacturers and very high prices for parts [T12] 13. Continuous change in supplier companies [T13]
8.	In the Area of Customers	14. Loss of customers due to international applied restrictions [T14]
9.	In the Area of Competitors in the Industry	15. The reduction of the full price of the products of foreign competing companies regarding the new technologies [T15]
10.	In the Area of Potential Competitors	16. Existence of various mines in Afghanistan and exploiting them in the near future [T16]



Table 6. Opportunities Identified from Collecting the Opinions of External Experts Council

Class	Dimensions to Be Investigated	Opportunities-O
1.	Economic and Political Areas	1. The price rise of base metals and their good prospects [O1]
2.	Cultural and Social Areas	2. Availability of skilled workforce [O2]
3.	Area of Existing Laws and Regulations	3. Making use of state monopoly conditions [O3] 4. Granting government credits for pollution reduction projects [O4]
4.	Environmental Areas Such as Water, Air, Energy	5. Existence of cheap energy in an industry sector [O5]
5.	Technological Area	6. Existence of new technologies for using low cutie mines [O6] 7. Emergence of new and efficient technologies in the fields of exploitation in terms of energy consumption and environmental impacts [O7] 8. Existence of highly creative and knowledge-based individuals and companies in the region as well as science and technology parks [O8]
6.	Physical Area Such as Geography	9. Having abundant mineral reserves [O9]
7.	In the Area of Suppliers	10. Existence of domestic and even indigenous suppliers to supply a large part of equipment [O10]
8.	In the Area of Customers	11. Development of downstream industries [O11]
9.	In the Area of Potential Competitors	12. Neighboring countries' need for geological knowledge, exploration, and production [O12]

### Extracting Strategies Regarding the Strengths, Weaknesses, Threat, and Opportunity

In conducting this research, after collecting opinions regarding the strengths, weaknesses, opportunities, and threats of the mining company and receiving opinions from experts in the field of strategic planning, these cases were categorized. Finally, the most important cases in each of the internal and external factors were listed. Afterwards, considering the internal and external factors, the SWOT analysis matrix was extracted and after investigating the internal strengths and weaknesses as well as external opportunities and threats, strategies were compiled in four dimensions of the SWOT matrix. Classification of strategy types according to the SWOT matrix is as follows [Karimi and Mahboobfar, 2012]:

#### *Offensive Strategies [SO] [Strength, Opportunity]*

It indicates that the organization is in the best possible performance conditions and can utilize its strengths, to exploit the maxim use

of its opportunities and to eliminate weaknesses and to prevent external threats too, and in such circumstances strategies such as concentration, diversity, integrity and other cases are adopted

#### *Conservative Strategies [WO] [Weakness, Opportunity]*

In this strategy, the organization while maintaining key strengths has to avoid being located in high-risk conditions; in such circumstances, strategies like productivity, service enhancement, and other cases are used.

#### *Competitive Strategies [ST] [Strength, Threat]*

It indicates that an organization while maintaining its strengths must use integrated and combined strategies such as market penetration, product development, services development, and creating organizational partnerships, and so on.

#### *Defensive Strategies [WT] [Weakness, Threat]*

In this strategy, the organization must remove its weaknesses and prevent external

threats too. Defensive strategies can be stated in the modification of processes and the optimization of activities, cost leadership, outsourcing, and so on.

These strategies are as the Table 7.

Table 7. Alpha Mining Company SWOT Matrix

	Strengths [S]	Weaknesses [W]
Opportunities [O]	<ol style="list-style-type: none"> <li>1. Increasing production by launching new lines [S1] [S2, S3, S5, S6, S8, S12, O1, O2, O8, O10]</li> <li>2. Investing in neighboring countries' mines to increase market penetration and impact coefficient [S2] [S1, S2, S6, S10, S12, O1, O8, O10, O12]</li> <li>3. Reduction of pollutants resulted from production [S3] [S1, S2, S3, S6, S8, S10, S13, O3, O4, O7, O8]</li> </ol>	<ol style="list-style-type: none"> <li>1. Comprehensive planning in human resources area to create an effective and efficient culture [S7] [W1, W2, W4, W15, W16, W18, O2, O8]</li> <li>2. Renovating and equipping production lines by new machineries [S8] [ W7, W8, O6, O7, O8, O10]</li> <li>3. Reorganizing forces in various affairs [S9] [S1, S2, S3, S18, O2, O8]</li> </ol>
Threats [T]	<ol style="list-style-type: none"> <li>1. Developing downstream industries to create added value and dealing with unemployment and sanctions [S4] [S1, S2, S6, S11, S12, S13, T2, T3, T4]</li> <li>2. Creating a Technology Transfer Office [TTO] in order to move towards self-sufficiency [S5] [S1, S6, S4, S7, S10, S11, S12, S13, T1, T2, T6, T9, T10, T12, T13]</li> <li>3. Increasing productivity by using full price reduction and increasing quality [S6] [S1, S2, S3, S5, S6, S8, S10, S13, T9, T10, T14, T15]</li> </ol>	<ol style="list-style-type: none"> <li>1. Investing in researches related to low-cutie mines exploitation [S10] [W9, W10, T11]</li> <li>2. Supply Chain Management System Deployment [S11] [W10, W16, T12, T13]</li> <li>3. Investigating existing machinery and optimizing their energy consumption as much as possible [S12] [W7, W8, T5, T6, T9, T10, T15]</li> <li>4. Deployment of knowledge management and surrogacy training systems [S13] [W6, W9, W11, W12, T2, T4]</li> <li>5. Assigning a part of the sale to eligible individuals or private companies [S14] [W19, T1, T2, T14]</li> </ol>

### Determining the Strategic Position of the Company

After identifying the internal and external factors of the Alpha Mining Company, the Internal Factor Evaluation [IFE] Matrix and the External Factor Evaluation [EFE] Matrix that are respectively resulted from the strategic investigation of the internal and external factors of the Alpha Mining Company will be obtained. For this purpose, after identifying the internal and external factors, each of these factors should be given an importance coefficient. These coefficients actually indicate the importance ratio of a factor in the success of the organization in the relevant industry. In addition, the weights in each one of the matrices must be allocated in such a way that their total sum is equal to 1. For this reason, matrices were provided to the members of an expert group and to determine the relative

coefficient of these factors, they were asked to allocate each one of the factors in terms of their importance degree a coefficient from zero [0=completely unimportant] to [10=having extreme importance]. As the coefficients of importance of each one of the internal and external factors have to be determined in a way that their sum becomes equal to 1, that is, the primary mean weight of each factor will be divided by the sum of the mean weights, hence the following formula is used:

$$\frac{\bar{x}_i}{\sum \bar{x}_i} = \text{Analyzed Weight}$$

Internal Factor Evaluation Matrix is obtained from a strategic investigation of factors within the organization. To prepare an internal factors evaluation matrix, the judgments of an expert group should be relied on. In a matrix, the expert group allocated the

ranks 1 to 4 in a way that the rank 1 indicates basic weakness, the rank 2 indicates relative weakness, the rank 3 indicates relative strength and the rank 4 indicates high strength in the relevant industry. In the External Factor Evaluation Matrix, the expert group will allocate scores 1 to 4, in a way that the rank 1 indicates poor reaction, the rank 2 indicates moderate reaction, the rank 3 indicates proper reaction, and the rank 4 indicates a very excellent reaction against opportunities and threats. To determine the weighted rank, each factor's weight will be multiplied by its rank.

The sum of final scores will be between 1 and 4 and their mean is 2.5. The intersection point of the obtained numbers of [IEF] and [EFE] in the analyzed sample will be located in one of the four aspects of the table that determines the desired strategy. According to the Matrix [IE], four main strategies are used for overall policy-making and ultimately for determining tactics. In the geometric location of [opportunity/ strength], the offensive strategy will be, in the [opportunity/weakness] section, conservative strategy will be, in the [strength/threat] position, competitive strategy will be, and ultimately in the [threat/weakness] section, defensive strategy will be. Another method that can be named for determining strategy based on geometrical positioning is to use Internal and External Factor Evaluation [IEFE], which can be analyzed using different specific and diagram formulas. This matrix is presented in two 9-house and 4-house forms. In this article, the 4-house form has been used. Depending on the volume of computations, only expressing the result is sufficient.

Table 8. Internal and External Matrix

4	<b>Conservative Strategies</b>	<b>Offensive Strategies</b>
2.5	<b>Defensive Strategies</b>	<b>Competitive Strategies</b>
1	2.5	4

According to the results obtained from the Internal and External Factor Evaluation method, the strategic position of the organization is in a defensive position. Conservative, defensive, and competitive strategies should; therefore, be investigated and prioritized, because the Alpha Mining Company is not clearly in the offensive position.

### Prioritizing Strategies

In this research, the WASPAS method is used to prioritize strategies. Criteria according to the ACCEPT method criteria include attainable, complexity, cost, effective, popularity, and time, that the definition of each one has been addressed below. Each selected strategy is weighted based on these six criteria [Abdullah & Adawiyah, 2014].

*Attainable:* The attainable of implementing the strategy according to current conditions and existing legal requirements,

*Complexity:* The complexity and difficulty of implementing a strategy such as specific skills to implement a strategy,

*Cost:* It takes into account the costs of implementing the strategy,

*Effective:* Effective of a strategy that emphasizes the creation of competitive advantage,

*Popularity:* The popularity of a strategy in the organization that considers intra- and inter-organizational resistances [such as strike and governmental and political requirements],

*Time:* Strategy implementation time [the shorter the strategy implementation time is, that strategy is located in priority].

The ACCEPT method uses six criteria to prioritize strategic goals. The criteria of the ACCEPT method provide an opportunity for the strategic planning team to evaluate the consequences of adopting a strategy from various aspects, and hence reducing the

common mistakes and errors in adopting incorrect strategies.

Shannon Entropy method has been used to determine the weight of the criteria. Entropy is a very important concept in the social, physical sciences and information theory. When the data of a decision-making matrix is completely clear, the Entropy method can be used to evaluate weights. The idea of the above method is that the higher the dispersion in the values of an index is, that index is more important. In Table 8 the decision-making matrix obtained from the expert group's opinions has been drawn. In this matrix, 11 competitive, conservative and defensive strategies are evaluated according to the six ACCEPT criteria, including attainable, complexity, cost, effective, popularity, and time.

Table 9. Decision Matrix According to ACCEPT Criteria

	Attainable	Complexity	Cost	Effective	Popularity	Time
S4	4	3	2	5	5	3
S5	5	4	4	4	5	4
S6	2	3	4	4	3	2
S7	4	3	2	4	5	1
S8	3	3	2	4	3	1
S9	2	3	4	4	5	3
S10	4	1	2	3	4	3
S11	2	2	3	5	4	3
S12	4	3	4	4	5	3
S13	2	2	2	4	5	3
S14	3	2	2	5	4	4

According to the above table values, and using the Shannon Entropy method, the final weight of the criteria is extracted as Table 10.

Table 10. Shannon Entropy Method Output

No.	Criteria	Entropy Value [Ej]	Uncertainty Value [Dj]	Criterion Weight [Wj]
1	C1	0.978	0.022	0.21
2	C2	0.98	0.02	0.187
3	C3	0.977	0.023	0.215
4	C4	0.996	0.004	0.038
5	C5	0.993	0.007	0.065
6	C6	0.97	0.03	0.285

Since the complexity, cost and time indices are negative and the rest of the indices are positive, then the linear soft is used for normalization. In Table 11 the normalized matrix is observed. In this method, two different equations are used to normalize the index with positive and negative aspects. If the criterion has a positive aspect:

$$n_{ij} = \frac{r_{ij}}{r_j^{max}}$$

And if the criterion has a negative aspect:

$$n_{ij} = \frac{r_j^{min}}{r_{ij}}$$

Then according to equations [3], [4] and [5] the values of Q1, Q2 and Q3 are obtained that have been shown in Table 12.

Table 11. Normalized Decision Matrix

	Attainable	Complexity	Cost	Effective	Popularity	Time
S4	0.8000	0.3333	1.0000	1.0000	1.0000	0.3333
S5	1.0000	0.2500	0.5000	0.8000	1.0000	0.2500
S6	0.4000	0.3333	0.5000	0.8000	0.6000	0.5000
S7	0.8000	0.3333	1.0000	0.8000	1.0000	1.0000
S8	0.6000	0.3333	1.0000	0.8000	0.6000	1.0000
S9	0.4000	0.3333	0.5000	0.8000	1.0000	0.3333
S10	0.8000	1.0000	1.0000	0.6000	0.8000	0.3333
S11	0.4000	0.5000	0.6667	1.0000	0.8000	0.3333
S12	0.8000	0.3333	0.5000	0.8000	1.0000	0.3333
S13	0.4000	0.5000	1.0000	0.8000	1.0000	0.3333
S14	0.6000	0.5000	1.0000	1.0000	0.8000	0.2500

Table 12. Decision Matrix along with the Weights Applied

	Attainable	Complexity	Cost	Effective	Popularity	Time	Q2	Q1	Q3
S4	0.8000	0.3333	1.0000	1.0000	1.0000	0.3333	0.7597	0.6937	0.7267
S5	1.0000	0.2500	0.5000	0.8000	1.0000	0.2500	0.7318	0.6341	0.6829
S6	0.4000	0.3333	0.5000	0.8000	0.6000	0.5000	0.5439	0.5231	0.5335
S7	0.8000	0.3333	1.0000	0.8000	1.0000	1.0000	0.8567	0.8328	0.8447
S8	0.6000	0.3333	1.0000	0.8000	0.6000	1.0000	0.7249	0.6973	0.7111
S9	0.4000	0.3333	0.5000	0.8000	1.0000	0.3333	0.5837	0.5286	0.5561
S10	0.8000	1.0000	1.0000	0.6000	0.8000	0.3333	0.6796	0.6403	0.6599
S11	0.4000	0.5000	0.6667	1.0000	0.8000	0.3333	0.6064	0.5521	0.5793
S12	0.8000	0.3333	0.5000	0.8000	1.0000	0.3333	0.6977	0.6440	0.6708
S13	0.4000	0.5000	1.0000	0.8000	1.0000	0.3333	0.6135	0.5572	0.5853
S14	0.6000	0.5000	1.0000	1.0000	0.8000	0.2500	0.6586	0.5924	0.6255

Therefore, prioritizing the strategies based on Q amount has been shown in Table 13.

Table 13. Prioritizing Strategies Based on the WASPAS Method

Priorities	Strategies	Scores
First Priority	S14	0.8447
Second Priority	S5	0.7267
Third Priority	S7	0.7111
Fourth Priority	S4	0.6829
Fifth Priority	S13	0.6708
Sixth Priority	S9	0.6599
Seventh Priority	S6	0.6255
Eighth Priority	S8	0.5853
Ninth Priority	S11	0.5793
Tenth Priority	S10	0.5561
Eleventh Priority	S12	0.5335

According to the WASPAS method in the final matrix, the option with the highest Q will have the highest priority.

## DISCUSSION AND CONCLUSION

Various approaches have already been proposed to prioritize strategies; in this research, the criteria have been specified using the ACCEPT approach and finally by the WASPAS method, the strategies have been prioritized. The ACCEPT method unlike the QSPM method, which prioritized strategies by taking into account strengths and weaknesses, opportunities and threats, regardless of environmental conditions and existing organizational status and externally by considering 6 main parameters of strategy evaluation including cost, time, popularity,

effective, and so on, helps to prioritize strategies. In this research, it was tried to use one of the techniques of MADM according to relevant and important criteria to enhance the assurance coefficient of managers' decision making. Multi-criteria decision-making techniques have this advantage that they evaluate various options according to various criteria that do not have equal units. Another important advantage of multi-criteria decision-making techniques is that they are capable of analyzing quantitative and qualitative criteria simultaneously. In this article, using the WASPAS method, the strategies of "assigning a part of sale to eligible individuals or private companies", "creating a Technology Transfer Office [TTO] in order to move towards self-sufficiency" and "comprehensive planning in the field of human resources in order to create an effective and efficient culture" were selected as strategic priorities for the Alpha Mining Company. The first strategy is among defensive strategies, the second strategy is in the field of competitive strategies and the third strategy is in the field of conservative strategies. Of course, it was foreseeable that in the new sanctions situation, along with the disordered human resources situation, strategies associated with them are located in the selection priority. For the first strategy, in order to move from the current sanction situation the company should act with private companies or individuals to advance export goals. In other words, a part of the sales unit activity must be outsourced. In the second strategy, the creation of a Technology Transfer Office in line with self-sufficiency has been mentioned. Generally, the importance of technology as the main factor and driving engine of economic growth in the world is



obvious and clear. There is no doubt that productivity improvement is very vital and important for an economic system that technology is the factor and the cause of such improvement. Technology transfer is a process that enables the flow of technology from one source to a receiver. In this case, the source is the owner or possessor of the knowledge, while the receiver is the beneficiary of such knowledge. The source can be an individual, a company or a country. Technology transfer, whether culturally, or politically and economically is among important and significant issues for developing countries as well as developed countries, and has required many international research organizations to conduct research and survey in this respect. The third strategy involves comprehensive human resource planning in order to create an effective and efficient culture, that with regard to the serious weaknesses that the Alpha Mining Company has in this area, and they have also been mentioned in the form of weaknesses, it hence seems that this strategy will be a very important priority, despite the fact that performing it takes time.

Future researchers are suggested use other multi-criteria decision-making techniques along with the WASPAS method to investigate strategy priorities and to compare them with macro goals and vision to prioritize strategies. In addition, the mentioned research can be performed for other mining or industrial companies in a similar way.

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## OPRACOWYWANIE I PRIORYTYZACJA STRATEGII PRZEDSIĘBIORSTWA ALPHA MINING COMPANY PRZY ZASTOSOWANIU METODY WASPAS

**STRESZCZENIE. Wstęp:** W obecnych czasach przedsiębiorstwa wydobywcze, jako organizacje non-profit, podobnie jak inne organizacje, działają w kompleksowych i zmieniającym się środowisku. Prawidłowe zarządzanie organizacją zależy od zrozumienia wewnętrznego jak i zewnętrznego środowiska oraz podejmowania strategicznych decyzji. Aby działać efektywnie, mając do czynienia z wieloma czynnikami wpływającymi na możliwości i ograniczenia wzrostu przedsiębiorstwa, organizacja potrzebuje strategicznego planowania dla rozwoju swoich zdolności, długoterminowego wzrostu jak i ograniczeniu ryzyka operacyjnego. Po etapie opracowania strategii, istotnym krokiem

jest ich priorytetyzacja. Statystyczna populacja w tej pracy obejmuje 50 kierowników operacyjnych i wspierających (dla określenia czynników wewnętrznych) oraz 10 menadżerów (dla określenie czynników zewnętrznych). Strategie zostały wpięrow poddane analizie SWOT (Strengths, Weaknesses, Opportunities, Threats) a następnie uszeregowane zgodnie z metodą WASPAS (Weighted Aggregates Sum Product Assessment).

**Materiały i metody:** Dodatkowo do podejścia QSPM, modele wieloczynnikowe podejmowania decyzji również mogą być zastosowane w procesie priorytetyzacji strategii. Obecnie wieloczynnikowe podejmowanie decyzji jest bardzo zintensyfikowane, z drugiej strony obserwowana jest tendencja nauk interdyscyplinarnych zastosowania teorii różnych obszarów w rozwiązywaniu kompleksowych problemów, konieczności zwrócenia uwagi na techniki analiz podejmowania decyzji oraz wykorzystywania ich w istniejących złożonych problemach. W tych modelach umożliwiające jest wybranie jednej opcji wśród istniejących wielu możliwości. Wieloczynnikowe podejmowanie decyzji odnosi się do specyficznych (preferowanych) decyzji, takich jak szacowanie, priorytetyzacja lub wybór jednej wśród wielu opcji (co czasem musi być dokonane przy wielu przeciwnych czynnikach). Takimi wieloczynnikowymi modelami podejmowania decyzji są: AHP, ANP, ELECTRE, VICTOR, TOPSIS, SAW, GRA, SIR, PROMETHEE oraz WASPAS. W prezentowanej pracy zastosowano metodę WASPAS dla określenia priorytetyzacji strategii.

**Wyniki:** Strategie wpięrow zostały zidentyfikowane poprzez zastosowanie macierzy SWOT (Strengths, Weaknesses, Opportunities, Threats) a następnie uszeregowane przy zastosowaniu metody WASPAS (Weighted Aggregates Sum Product Assessment). W końcowym etapie strategii „przypisanie części sprzedaży do indywidualnych osób lub wykwalifikowanych prywatnych firm”, „stworzenie TTO (Technology Transfer Office) w celu przesunięciu w stronę samowystarczalności” oraz „wszechstronne planowanie w obszarze zasobów ludzkich w celu wytworzenia efektywnych i wydajnej kultury” zostały wybrane jako strategiczne priorytety dla firmy Alpha Mining Company.

**Wnioski:** Różne metody były proponowane do użycia w celu priorytetyzacji strategii. W tej pracy kryteria zostały wybrane poprzez podejście ACCEPT oraz finalnie poprzez metodę WASPAS. Metoda ACCEPT pomaga w priorytetyzacji strategii w przeciwieństwie do metody QSPM, która priorytetyzuje strategię uwzględniając ich słabe i mocne strony, możliwości i zagrożenie w oderwaniu od warunków środowiskowych i aktualnego stanu organizacji, a uwzględniając 6 głównych parametrów oszacowywania strategii, takich jak koszt, czas, popularność, efektywność, itp. W pracy spróbowano użyć jednej z metod MADM w odniesieniu do istotnych kryteriów w celu zapewnienia współzależności podejmowanych decyzji przez zarządzających. Wieloczynnikowe techniki podejmowania decyzji mają tą przewagę, że umożliwiają ocenę różnych opcji w zależności od różnych kryteriów, które nie mają wspólnej jednostki przeliczeniowej. Inną zaletą wieloczynnikowych technik podejmowania decyzji jest możliwość jednoczesnej analizy czynników jakościowych i ilościowych.

**Słowa kluczowe:** macierz SWOT, planowanie strategiczne, WASPAS, ACCEPT

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