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Application of Combined SWOT and AHP: A Case Study for a Agricultural Firm

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ABSTRACT

SWOT is a familiar business and marketing perspective which can help the management and all the interested parties to catch the main points in the organization or industry, its assets and liabilities, and opportunities and threats in the market. SWOT analysis can be considered as one of the most basic tools for decision-making since it offers an analysis of a situation. The purpose of this research is to design a strategy that could help to solve the main issue, namely absence of the clear prioritization of the criteria used within the SWOT analysis. To make the use of SWOT analysis more effective, the current study recommends applying another MCDM technique, namely, the Analytic Hierarchy Process (AHP). The AHP is another method of assessing factors or criterion by pair wise comparison through eigenvalue which is a typical method of comparing factors as well as criterion. The identified integrated approach is based on the necessity to solve the issues regarding quantitative effectiveness of strategic planning.

Keywords: SWOT, Analytic Hierarchy Process (AHP), Decision-making, Agricultural

INTRODUCTION

This suggests that there must be a fit between business management and the internal/external environment in which the Company operates for it to succeed. SWOT is one of the most effective tools practitioners apply to understand the sum of forces that are beneficial and those that are detrimental in overall organizations' performance.

SWOT analysis is one of the most significant tools of strategic planning that help to identify all the strengths and weaknesses of the particular business or project, as well as to define all the opportunities and threats that can occur. It is method used in the field of strategic management and analytical strategy for both situations. SWOT analysis may not effectively assess the importance of variables in a particular context and leaves incapable of assessing decision prospects depending on helpful criteria (Nguyen &

Truong, 2022).

Based on the evaluation result of the previous recommendation, this study developed a quantitative AHP to conduct the SWOT analysis in order to order the weightings of SWOT factors. The approach involves successively comparing the components of the SWOT model to identify them. The eigenvalue technique was used to evaluate the importance and ranking of SWOT criteria in the Analytical Hierarchy Process comparison matrices of the Analytical Network Process (Yavuz & Baycan, 2013). The study demonstrates how the SWOT-AHP conceptual framework may be utilized to analyse strategic decisions.

SWOT AND AHP MODEL

SWOT Analysis

SWOT on its part is extensively used in making an analysis of the internal and external environments to get a framework and backing for the decisions made.

Strategic factors involve the strategic components that include internal and external factors that are of primary significance to the firm. The factors are classified into four distinct sections referred to as SWOT groups: named as the SWOT analysis that includes strengths, weaknesses, opportunities, and threats. The justification of using SWOT when making strategic plans and decisions is to find a suitable and efficient strategy that can accommodate the inside and outside environment in the firm. In addition, it is crucial that the selected strategy matches the aims of the current and upcoming decision-making processes. SWOT is a method, which means a systematic study and reasonable assessment of factors, which are relevant in terms of a new product, technology, management or planning. SWOT analysis is shown Figure 1 as a component of an environmental scan of the organization.

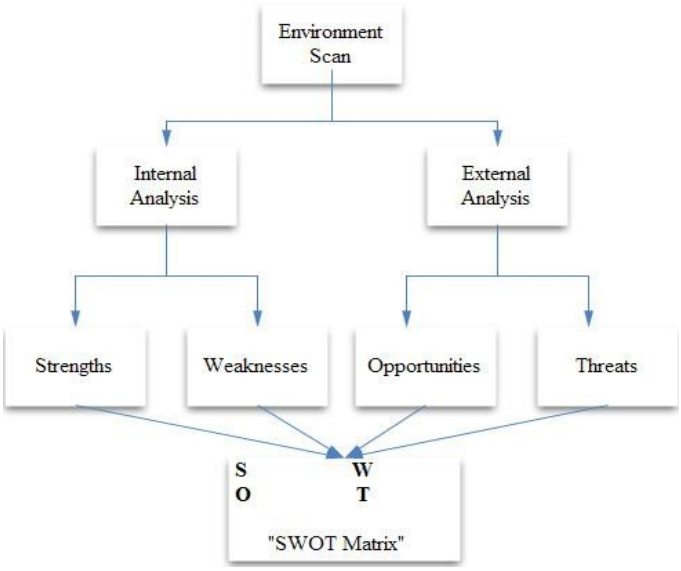

Figure 1: SWOT analysis framework

Analytic Hierarchy Process

AHP, an example of a multi-criteria decision-making technique, can be utilized to implement each stage of the decision-making process. It breaks down the complex challenges into several levels of simpler structures, including options, criteria, and sub-objectives. The Analytic Hierarchy Process (AHP) is a distinctive method that entails comparing variables at different levels of a hierarchy and evaluating the alternatives at the final level of the hierarchical model. Therefore, AHP is a highly effective tool for decision making that should be used in situations where subjectivity is a factor. This strategy is applicable when the choice parameters are clearly specified and can be analyzed in relation to sub-criteria, as in the context of problem solving.

It is utilized to determine priorities on absolute quantitative scales by comparing both discrete and continuous pairs in a hierarchical framework with multiple levels. The mechanism for prioritization is developed a comparison scale that is utilized to assign a numerical number to the importance of a condition (Saaty, 1980). Project members rank the identified criteria. Moreover, the selection of these components and their levels of significance is determined by creating a matrix for pairwise comparisons.

Table 1: Pairwise comparison scale

Importance	Explanation
1	Two criterion contribute equally to the objective
3	Experience and judgement slightly favor one over another
5	Experience and judgment strongly favor one over another
7	Criterion is strongly favored and its dominance is demonstrated in practice
9	Importance of one over another affirmed on the highest possible order
2, 4, 6, 8	Used to represent compromise between the priorities listed above

The Analytic Hierarchy Process (AHP) is based on three core principles: ranking the ideas, evaluating the criteria and/or alternatives, and integrating the priorities inside the model's architecture. The paper demonstrates the extensive utilization of AHP in the literature for tackling various decision-making difficulties. The key choice problem in the first phase is organized hierarchically. Firstly, the Analytic Hierarchy Process (AHP) breaks down a complicated and contradictory decision with various criteria into a set of interconnected decision pieces, such as criteria and decision alternatives (Ibrahim et al., 2021). The AHP synthesizes the objectives, decision criteria, and alternatives in a hierarchical structure that resembles a branch of a family tree. The final objective is situated at the apex of the delineated hierarchy of objectives, which must consist of at least three tiers. The middle level consists of a set of criteria that determine the available possibilities, while the bottom level is composed of the actual options themselves.

In this instance, the authors utilize the Analytic Hierarchy Process (AHP) to assist in determining the relative importance of different elements inside the SWOT analysis. Hierarchy completion is conducted to ascertain the importance of the criterion once the hierarchical structure has been established and the problem has been divided. The criteria are systematically compared at each level, with particular attention given to the defined criteria and their respective degrees of importance at higher levels. The Analytic Hierarchy Process (AHP) employs a 9-point crosswise comparison scale to simplify the evaluation process, as it often involves numerous comparisons.

Define the collection of related criteria as C = { Cj | j = 1, 2, ……n } In a square evaluation matrix of dimension (n x n), each entity an i,j [i, j =1,2,...,n] reflects the ratio of the weights of two criteria. Additionally, it can be succinctly summarized by comparing n numbers of criteria in a pairwise manner. The process of comparing pairs can be accomplished by utilizing a scale and reciprocal matrix, as demonstrated in Equation (1).

$$A=(a_{ij})_{n\times n}=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ a_{n1} & a_{n2} & \cdot & a_{nn} \end{bmatrix}$$

The final step entails the normalization of each matrix and the determination of the weights of its relatives. The right eigenvector (w) that corresponds to the largest eigenvalue (λ_{max}) is the source of the relative weight.

Aw= max.w

The maximum value of matrix A is n if the pairwise comparisons are entirely consistent. In this case, the weights can be determined by normalizing either the rows or columns of matrix A. The consistency of the judgement made during pairwise comparisons is directly correlated with the quality of the AHP's output. The relationship between the entries of A determines its consistency: $_i$ x $_i$ = $_k$. The Consistency Index (CI) can be computed using the subsequent formula:

$$CI=\frac{\lambda_{max}-n}{n-1}$$

Using the final consistency ratio (CR) can conclude whether the evaluations are sufficiently consistent. The CR is calculated as the ratio of the CI and the random index (RI), as indicated in Eq. 4

$$CR=\frac{CI}{RI}$$

The accepted upper limit for CR is 0.1. The evaluation procedure must be repeated in order to enhance consistency if the final consistency ratio exceeds this value.

Table 2: Random index [6, 20]

n	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

SWOT-AHP Model

The eigenvalue method in AHP is used to assess the relative significance of evaluation factors and make pairwise comparisons between them. At times, it can be challenging to assess the significance of the aspects that pertain to the business in order to determine their influence on the proposed strategic options in the SWOT analysis. It is not feasible to use a SWOT analysis to rank decision alternatives based on these criteria or to gradually determine the relative importance of the factors. In order to address this deficiency, the model is integrated and examined using the Analytic Hierarchy Process (AHP) and its eigenvalue calculation approach. Subsequently, the SWOT framework is reconfigured into a CPA HP structure.

Firstly, it is essential to systematically evaluate and compare the aspects under consideration in the SWOT analysis, in accordance with the specifications of the Analytic Hierarchy Process (AHP) approach. This has been achieved by employing the prescribed approach, which has been executed in three separate stages.

Prior to commencing the construction of the fundamental strategic planning model, known as the SWOT analysis, it is necessary to compile a comprehensive inventory of all external threats and opportunities that are relevant to the organization, as well as all internal strengths and weaknesses that may be encountered.

Pairwise comparisons are utilized in the second phase of the construction process to evaluate the relative importance of each SWOT category. Thus, the third stage of the Analytic Hierarchy Process (AHP) involves ranking the elements inside the AHP framework to determine the relative importance of factors in each category using the SWOT technique. Thus, the final weights of the factors at the local level are determined by multiplying the individual weights with the weight of the group in question, resulting in the overall rank of the component weights.

The study conducted employed the Analytic Hierarchy Process (AHP) tool in conjunction with the integration of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis (Kurttila et al. ,2000). The process of planning was enhanced by organizing and aligning the evaluated components, and by introducing a more analytical approach. SWOT and AHP have been extensively utilized and examined in diverse sectors of application. The combined utilization of these tools is considered one of the most commonly employed methodologies in this domain. From an application perspective, it has been utilized to determine outsourcing solutions for sport marketing, assess and choose management strategies for a forestland estate, analyse and determine the strategic marketing plan for the revival of the Sri Lankan tourism industry, devise strategies for managing natural resources, evaluate the competitiveness of a global machine tool manufacturing industry, and identify solutions for the safe transportation of bulk products.

METHODOLOGY AND APPLICATION

The primary goal of integrating the AHP into the SWOT framework is to conduct a systematic evaluation of the SWOT factors and to reconcile their relative importance. The AHP structure in this study is derived from the SWOT matrix and is further divided into three components: (a) the decision's objective, (b) the SWOT groups, and (c) the factors within each SWOT group (sub-criteria). The SWOT structure's hierarchical

representation is illustrated in Fig. 2.

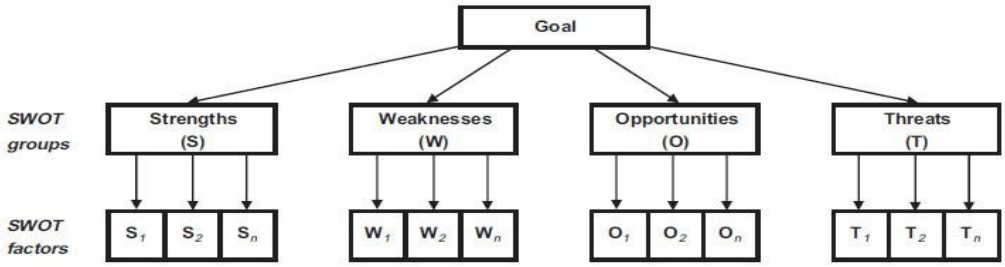

Figure 2: Hierarchical structure of the SWOT matrix.

In the following case study, the Analytic Hierarchy Process (AHP) is enhanced by performing a SWOT analysis on a company based in Istanbul, Turkey, that specializes in manufacturing cooker hoods. The company generally ships its products to over 50 countries globally. We utilized Saaty's comparison scale to perform pairwise comparisons and determine the relative importance of each pair of SWOT factors. After digitizing the SWOT frame using AHP, the vector weights or priorities for the groups and factors being analyzed can be determined using the aggregated matrix that was obtained. We have devised a strategic management model consisting of three distinct phases, namely the creation of an initial task, the adjustment of factors, and the establishment of an evaluation model (Figure 1). This model is built upon the SWOT-AHP framework. Firstly, the SWOT analysis is carried out, and the matrix is structured. The SWOT matrix delineates and assembles the relevant factors and internal environment.

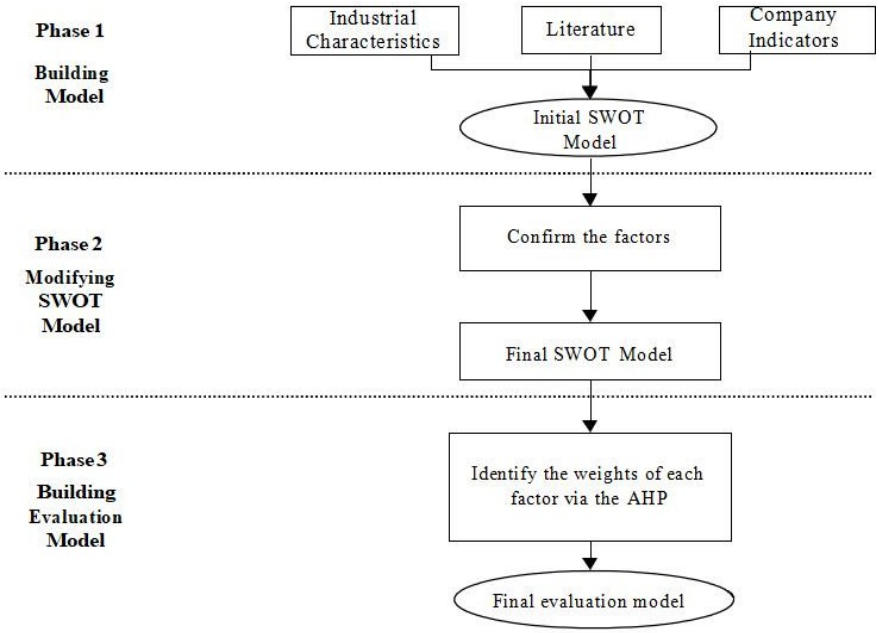

Figure 3: Phases of proposed methodology

Table 3: SWOT Matrix

Strength (S)	**Weaknesses (W)**
(S1) Favorable Climate and Soil **(S2)** Established Infrastructure **(S3)** Government Support **(S4)** Skilled Labor Force **(S5)** Large Plantation Areas	**(W1)** Environmental Concerns **(W2)** Labor Issues **(W3)** Market Dependence **(W4)** Sustainability Issues **(W5)** Infrastructure Maintenance
Opportunities (O)	**Threat (T)**
(O1) Growing Global Demand **(O2)** Sustainable Practices **(O3)** Diversification **(O4)** Research and Development **(O5)** Trade Agreements	**(T1)** Environmental Regulations **(T2)** Market Fluctuations **(T3)** Competition **(T4)** Climate Change **(T5)** Activism and Boycotts

Strengths, Weaknesses, Opportunities, and Threats (SWOT) matrix analysis is conducted using the Analytic Hierarchy Process (AHP). Comparison scale is employed to conduct pairwise comparisons of the SWOT group, with a rating range of 1 to 9. Table 4 illustrates the comparative results. Subsequently, a comparison scale is implemented to evaluate the components of the SWOT matrix. Table 4 illustrates the comparative results. Additionally, considering each SWOT category. The application's comparisons between pairs are conducted by a team of professionals. A team of experts was established, which included members from three distinct departments. The authors of this document and the individuals responsible for managing the firm.

Table 4: Pairwise comparison of SWOT factors

SWOT Groups	**S**	**W**	**O**	**T**	**Importance Degrees of SWOT Groups**
Strengths (S)	1.000	0.500	0.140	0.170	0.064
Weaknesses (W)	2.000	1.000	1.000	0.250	0.174
Opportunities (O)	7.000	1.000	1.000	1.000	0.327
Threats (T)	6.000	4.000	1.000	1.000	0.435

CR= 8.5%

Table 5: Comparison Matrix of Strengths Group

Strengths	S1	S2	S3	S4	S5	Importance Degrees
Favorable Climate and Soil (S1)	1.000	0.170	0.170	0.200	0.120	0.038
Established Infrastructure (S2)	6.000	1.000	3.000	2.000	4.000	0.417
Government Support (S3)	6.000	0.330	1.000	0.500	1.000	0.150
SkilledLabor Force (S4)	5.000	0.500	2.000	1.000	2.000	0.237
Large Plantation Areas (S5)	8.000	0.250	1.000	0.500	1.000	0.158

CR = 6.1%

Table 6: Comparison Matrix of Weaknesses Group

Weaknesses	W1	W2	W3	W4	W5	Importance Degrees
Environmental Concerns (W1)	1.000	1.000	0.170	0.140	0.500	0.006
LaborIssues (W2)	1.000	1.000	0.140	0.170	0.500	0.059
Market Dependence (W3)	6.000	7.000	1.000	2.000	3.000	0.440
Sustainability Issues (W4)	7.000	6.000	0.500	1.000	2.000	0.309
Infrastructure Maintenance (W5)	2.000	2.000	0.330	0.500	1.000	0.132

Consistency Ratio (CR) = 1.5%

Table 7: Comparison Matrix of Opportunities Group

Opportunities	O1	O2	O3	O4	O5	Importance Degrees
Growing Global Demand (O1)	1.000	0.250	0.140	0.140	0.200	0.370
Sustainable Practices (O2)	4.000	1.000	0.200	0.170	1.000	0.102
Diversification (O3)	7.000	5.000	1.000	1.000	1.000	0.306
Research and Development (O4)	7.000	6.000	1.000	1.000	3.000	0.388
Trade Agreements (O5)	5.000	1.000	1.000	0.330	1.000	0.167

Consistency Ration (CR) = 7.0%

Table 8: Comparison Matrix of Threats Group

Threats	T1	T2	T3	T4	T5	Importance Degrees
Environmental Regulations (T1)	1.000	1.000	1.000	0.2000	5.000	0.152
Market Fluctuations (T2)	1.000	1.000	1.000	0.200	4.000	0.142
Competition (T3)	1.000	1.000	1.000	0.330	2.000	0.135
Climate Change (T4)	5.000	5.000	3.000	1.000	6.000	0.519
Activism and Boycotts (T5)	0.2000	0.250	0.500	0.170	1.000	0.052

Consistency Ration (CR) = 4.9%

Finally, the SWOT factors are assessed and assigned priority scores. The table labelled as Table 9 displays the main priorities in a comprehensive manner.

Table 9: Overall Priority Scores of SWOT Factors

SWOT Group	Group Prioriy	SWOT Factors	Factor Priority within the Group	Overall Priority of Factor
Strengths	0.064	Favorable Climate and Soil	0.038	0.002
		Established Infrastructure	**0.417**	**0.027**
		Government Support	0.150	0.010
		Skilled Labor Force	0.237	0.015
		Large Plantation Areas	0.158	0.010
Weaknesses	0.174	Environmental Concerns	0.006	0.001
		Labor Issues	0.059	0.010
		Market Dependence	**0.440**	**0.076**
		Sustainability Issues	0.309	0.053
		Infrastructure Maintenance	0.132	0.223
Opportunities	0.327	Growing Global Demand	0.370	0.121
		Sustainable Practices	0.102	0.033
		Diversification	0.306	0.100
		Research and Development	**0.388**	**0.127**
		Trade Agreements	0.167	0.055
Threats	0.435	Environmental Regulations	0.152	0.066
		Market Fluctuations	0.142	0.062
		Competition	0.135	0.059
		Climate Change	**0.519**	**0.226**
		Activism and Boycotts	0.052	0.023

CONCLUSION

According to the given SWOT analysis, the factors with the greatest overall priority suggest important areas that the organization should focus on. The key advantages of the region include the well-developed infrastructure (0.027) and highly skilled labour force (0.015), which are further bolstered by moderate government support and expansive plantation areas. Nevertheless, there are significant obstacles that need to be addressed strategically, such as the reliance on the market (0.076) and concerns regarding sustainability (0.053). The opportunities are driven by research and development (0.127) and increasing global demand (0.121), highlighting the potential for innovation and market growth. In contrast, climate change (0.226) and environmental regulations (0.066) are the primary threats, highlighting the necessity for proactive environmental strategies. In summary, the analysis emphasizes the importance of utilizing existing infrastructure strengths and research opportunities, while also addressing any vulnerabilities in the market and environment.

LIMITATION

A distinction has been made between some important features as understood by the current and past personnel within the organization. However, the rank of these factors has been identified using Doing Business's Analytical Hierarchy Process (AHP) on a sample including domains like government support, skilled workforce, large plantations availability, environmental factors, workers and its rights, market reliance, increasing global market demand, research and development, international relations, environmental constraints, competition, and climatic changes. Subsequent researchers are encouraged to compare results of SWOT analysis with expert ratings aiming at having deep and wide-angle perception about the subject.

REFERENCES

Ahmad, F., & Siwar, C. (2011). Factors influencing the economic efficiency of palm oil plantations in Sabah. Journal of Environmental Management, 92(4), 1055-1061.

Albayrak, E., & Erensal, Y. C. (2004). Using analytic hierarchy process (AHP) to improve human performance: An application of multiple criteria decision making problem. Journal of Intelligent Manufacturing, 15, 491-503. https://doi.org/10.1023/B:JIMS.0000034112.00652.4c

Borajee, M., & Yakchali, S. H. (2011). Using the AHP-ELECTRE III integrated method in a competitive profile matrix. International Conference on Financial Management and Economics Proceedings, 68-72.

Gao, C., & Peng, D. (2011). Consolidating SWOT analysis with nonhomogeneous uncertain preference information. Knowledge-Based Systems, 24(6), 796-808. https://doi.org/10.1016/j.knosys.2011.03.001

Gürel, E. (2017). SWOT analysis: A theoretical review. Journal of International Social Research, 10(51), 994-1006. https://doi.org/10.17719/jisr.2017.1832

Houben, G., Lenie, K., & Vanhoof, K. (1999). A knowledge-based SWOT-analysis system as an instrument for strategic planning in small and medium sized enterprises. Decision Support Systems, 26(2), 125-135. https://doi.org/10.1016/S0167-9236(99)00024-0

Ibrahim, T., & Raphael, F. F. (2021). Multi-criteria SWOT-AHP analysis for the

enhancement of agricultural extension services in Kano State, Nigeria. Journal of Deyland Agriculture, 7(5), 77-87. https://doi.org/10.5897/JODA2021.0069

Kangas, J., Pesonen, M., Kurttila, M., & Kajanus, M. (2001). A'WOT: Integrating the AHP with SWOT analysis. Proceedings of the 6th ISAHP Conference, Berne, Switzerland, 189-198.

Kurttila, M., Pesonen, M., Kangas, J., & Kajanus, M. (2000). Utilizing the analytic hierarchy process (AHP) in SWOT analysis: A hybrid method and its application to a forest-certification case. Forest Policy and Economics, 1(1), 41-52. https://doi.org/10.1016/S1389-9341(99)00004-0

Lee, S., & Walsh, P. (2011). SWOT and AHP hybrid model for sport marketing outsourcing using a case of intercollegiate sport. Sport Management Review, 14(4), 361-369. https://doi.org/10.1016/j.smr.2010.12.003

Pesonen, M., Kurttila, M., Kangas, J., Kajanus, M., & Heinonen, P. (2001). Assessing the priorities using A'WOT among resource management strategies at the Finnish forest and park service. Forest Science, 47(4), 534-541. https://doi.org/10.1093/forestscience/47.4.534

Saaty, T. L. (1980). The Analytic Hierarchy Process. New York: McGraw-Hill.

Sharma, M. J., Moon, I., & Bae, H. (2008). Analytic hierarchy process to assess and optimize distribution network. Applied Mathematics and Computation, 202(1), 256-265. https://doi.org/10.1016/j.amc.2008.01.006

Nguyen, T., & Truong, C. (2022). Integral SWOT-AHP-TOWS model for strategic agricultural development in the context of drought: A case study in Ninh Thuan, Vietnam. International Journal of the Analytic Hierarchy Process, 14(1). https://doi.org/10.13033/ijahp.v14i1.1008

Wang, J. J., & Yang, D. L. (2007). Using a hybrid multi-criteria decision aid method for information systems outsourcing. Computers & Operations Research, 34(12), 3691-3700. https://doi.org/10.1016/j.cor.2006.01.017

Yavuz, F., & Baycan, T. (2013). Use of SWOT and analytic hierarchy process integration as a participatory decision-making tool in watershed management. Procedia Technology, 8, 134-143. https://doi.org/10.1016/j.protcy.2013.11.019