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Sustainable Higher Education Reform Quality Assessment Using SWOT Analysis with Integration of AHP and Entropy Models: A Case Study of Morocco

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Abstract: Sustainable development goals (SDG) involve not only environmental issues but also economic, social, and cultural concerns. Higher education plays a key role in promoting sustainable development initiatives and in empowering people to change their thinking and to strive for a sustainable future. However, the main issue that needs to be presently resolved is how leaders, teachers, and students in higher education can achieve sustainable development in their system vision, mission and values, strategic plans, and organizational culture. Morocco is a country with a long history of higher education and has continuous reforms for sustainable development. In the process of responding to the wave of globalization, the Moroccan government has begun to formulate a higher education reform plan to maintain its competitiveness and achieve the SDG standards. Therefore, this study is focused on the quality of the higher education system through which the sustainability of higher education reform can be implemented. With this in mind, an organized approach that involved a questionnaire using the SWOT (strengths, weaknesses, opportunities, and threats) decision-making model with integration of analytic hierarchy process (AHP) and Entropy method was developed. The questionnaires were filled out by the experts, staff, and students of the higher education system (universities) to obtain the important key factors for the SWOT analysis. The AHP was used for the qualitative analysis of the weights of the SWOT factors, while the Entropy method was applied for the objective analysis of the number of different weight attributes. After integration of AHP with Entropy, the finalized variables were ranked; these results are more reliable and realistic to decision-makers. Finally, the SWOT matrix was established based on the questionnaire assessment and the AHP with Entropy weights to help implement the higher education reform policy and to monitor the quality of the current education system. The results also indicate that higher education reform must incorporate many changes, including effective budget planning, skilled experts, internationalization, improved and expanded infrastructure, reformed study curriculum, and latest training.

Keywords: sustainable higher education; SWOT decision-making; AHP and entropy; strategy and policy recommendation; higher education reform

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1. Introduction

Since the 1990s, the concept of sustainable development has been gradually accepted by countries all over the world. Developing countries are even more powerful promoters and practitioners of this concept [1]. The infiltration of the concept of sustainable development into various fields, such as the environment, technology, education, and especially

the development of sustainable development in higher education, is becoming increasingly important [2]. Raising awareness of environmental challenges and poverty issues means that environmental education, quality education, and development policy education must be sustainability oriented. This makes people more aware that higher education must be tailored to the goals of national and global sustainable development. Moreover, the idea of sustainable development takes root in all areas of higher education and can also improve the sustainability of higher education itself.

With the increasingly severe employment situation and the intensification of social and economic polarization, people's demand for new skills continues to rise. The current higher education system can no longer meet the need for cultivating high-quality future citizens and labor; thus, the education model needs to be urgently changed. From a global perspective, the current education system has been affected by the first and second industrial revolutions [3]. To this day, several higher education systems have continued the previous education model; many education systems in developed and developing countries still rely on direct teaching and passive learning. However, today, innovation has become a key driving force for the development of a new level of productivity in the economy. The third and fourth industrial revolutions have introduced production automation and intangible value creation. These new factors have caused tremendous changes in the way people work; as a result, many students will engage in new types of work and enter a new work model [4].

The Kingdom of Morocco, located in northern Africa, is a country with a long history and culture. Before becoming a French protectorate in 1912, Morocco had established a relatively complete traditional education system with Islam as its core content. Moroccan higher education can be traced back to the University of Al Quaraouiyine established in the 9th century (859). Karavin University is one of the most important spiritual and educational centers of the Muslim world in history. The school's education focuses on Islamic religion, law, and classical Arabic. In 1963, the school was incorporated into the Moroccan modern public university system. Calaviin University is regarded by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Guinness World Records as the oldest surviving higher education institution that awards degrees and continues to operate; it is sometimes considered the oldest university in the world [5].

During the period of French colonial rule over Morocco from 1912 to 1956, France adopted a policy of educational assimilation and transplanted the French education system to Morocco. The purpose was to cultivate the Moroccan elites with the values of suzerainty. From the 1980s to the 1990s, African higher education has entered a crisis period due to the economic recession in Africa, reduced government support for higher education, official corruption, mismanagement of universities, government intervention in university affairs, and the adverse effects of European colonial educational heritage on the development of higher education in Africa, etc. Moroccan higher education is also facing the same difficulties.

At the end of the 20th century, in the face of the continuous development of economic globalization, the increasingly fierce international economic competition, and the profound impact of economic globalization on the development of education, the Moroccan government carried out a comprehensive reform of the country's education [6]. Table 1 shows the list of reforms in Morocco and key points of focus in improvement of higher education system.

Table 1. Higher education reform in morocco in the last 20 years.

Education Reform	Duration and Years	Key Focus in Reforms
The National Education and Training Charter [6]	1999–2009 (10 years)	• Democratization of education • Promotion of quality education
National Emergency Education Plan [6]	2009–2012 (4)	• High enrollment rate • More higher education institutes (HEI) • Supporting research and innovations • Professional training schools
Education Action Plan [7]	2013–2016 (4)	• Rural areas development • Vocational education and training programs expansion • Link of professionals • Partnerships with schools
Strategic Vision for the Moroccan School Reform [7]	2015–2030 (15)	• Equity and equality in education • Child rights and ensuring the right to education • Determining the outcomes of education • Compulsory enrollment in preschool, primary school, and middle school for all students • Sustainable development • Internationalization • Partnership with stockholders • Achieving the standard of the Fourth Industrial Revolution (Industry 4.0) • Empowerment of human capital • Economic growth and strategy • Structured transformation in institutionalized schooling

The SWOT (strength, weakness, opportunity, and threat) analysis method is a decision-making model that selects the best survival and development strategy [8] after a comprehensive analysis of the internal and external environment of an organization. In SWOT analysis, analyzing the internal situation of the organization can locate special abilities, while examining the external situation can determine the potential success factors of the organization [9]. The internal and external analyses together form the basis of the combination of analysis strategies. The SWOT method represents the advantages and disadvantages of internal factors and the potential and challenges in the external environment (as shown in Figure 1). The correct strategy should be based on its development advantages, making full use of its potential, eliminating threats, weakening disadvantages, and achieving the goal of organizational development [10]. The main purpose of the SWOT analysis method is to objectively evaluate the situation of the organization, identify certain factors, clarify their thinking, and plan their development strategies [11].

SWOT analysis is now being used in every field where decision-making is an important aspect, such as environmental sustainability [12], industry 4.0 adoption [13], higher education quality management [14], and risk assessment [15]. However, common issue is that the criteria factors cannot be quantitively measured, making it hard to determine which variable primarily influences the strategic decision [10]. Nonetheless, when paired with the analytic hierarchy process (AHP), the quantitative analysis of these criteria factors can be achieved. The idea of using the SWOT and AHP together is not new and has been used in many applications for strategic planning [16]. To illustrate, (a) Etongo et al. [17] highlighted the issues and challenges facing forest management; (b) Wang et al. [18] focused on strategic planning for the assessment of the sustainability of renewable energy in Pakistan; (c) Liu et al. [19] studied the impact of tourism on the economic zone; (d) Mor et al. [20] used it to solve the issues of supply and chain management of dairy businesses;

(e) Gottfried [21] deployed the decision-making model to examine the behavior of users in investment; (f) Islam et al. [22] made strategic development for the pottery industry; and (g) Guerrero et al. [23] designed a strategy for addressing poverty. The effective application of the SWOT-AHP method in several domains making us to use this method as well in our research for higher education.

Figure 1. Strengths, weaknesses, opportunities, and threats (SWOT) analysis framework with details about internal and external factors.

Multi-criteria decision-making (MCDM) models (Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR), characteristic objects method (COMET) [24], Complex Proportional Assessment (COPRAS), and PROMETHEE II: Preference Ranking Organization Method for Enrichment of Evaluations) for quality assessment has been applied to many industries, such as e-commerce development, software development, groundwater pollution, forestry, health centers, transport [25] etc. quality assessment and evaluation [26]. Usually based on measuring the impact of quality, the academic community is also exploring the use of different methods to determine the level of quality. Wang et al. [27] used probability, analytic hierarchy process (AHP) technology, and entropy (Shannon) technology to assess quality of physical education. Using fuzzy logic to make decisions through linguistic variables, entropy technology is also applied to weighted decision matrices. Entropy technology can be used to determine the priority of risk, but it cannot be used to determine the calculation of risk level.

The methods of determining weights are mainly divided into three categories: subjective weighting method [28], objective weighting method [29], and comprehensive weighting method [30]. Commonly used subjective weighting approaches include the expert survey method (Delphi method) [31], analytic hierarchy process (AHP) [32], and binomial coefficient method [33]. Among them, the AHP is the most famous and widely used method for weight calculation and quantitative decision due to its system and simplicity [34–36]. However, it is also inevitable that its weights are subjective and arbitrary. Besides that, different results will be obtained if the decision variables are not selected correctly [37], therefore, we used SWOT analysis with AHP to improve AHP results accuracy. In addition, the commonly used objective weighting methods include the entropy method (Entropy) [38] and the principal component analysis method [39]. Between the two, the entropy method is used more often. This weighting method is based on the degree of variation of each indicator and uses information entropy to find each indicator using the entropy value to modify the weight of each indicator; the result obtained is more objective [40]. Since the entropy method is used for objective decision-making, it cannot reflect the experience and skill of experts [41]. Therefore, the results obtained sometimes

do not match the actual importance. This paper efficiently used both methods for the subjective and objective valuation of the decision-making process and, taking into account their benefits and disadvantages, developed AHP-Entropy; it is a coupled, comprehensive weighting approach that utilized the full advantage of both methods and improved the decision-making process by combining it with the SWOT analysis.

Motivation and Research Questions:

This research was conducted in a context in which universities are under intense pressure to adopt Morocco's higher education reforms to improve their sustainability and quality management efforts. To minimize research gaps, this study focused on the quality factors of the higher education system and gives the government and other stockholders strategic decision-making policies. The SWOT analysis was used in combination with AHP and Entropy; this was probably the first instance when this combined approach was employed to quantify the performance and quality assessment of HEIs and to develop the strategic policy for adopting the reforms accordingly. This research also highlighted the risk factors that need to be reduced to adopt the ongoing reform of higher education systems. From previous studies, it is evident that the Moroccan higher education reforms and HEIs need strategic planning to achieve the SDGs and Industry 4.0.

The gaps which are highlighted in above literature raise the following important questions that will guide this research work:

- What are the important factors that have an impact on the higher education system and which are perceived to be a risk factor for the quality of the education system?
- What factors need to be considered by Morocco's higher education system for adopting the Education 4.0 changes?
- What should the strategic planning of the higher education system be for the implementation of a sustainable education system in Morocco?
- How to use SWOT analysis more efficiently in combination with AHP and Entropy to improve decision-making?
- What is the policy recommendation for a smooth reform of Morocco's higher education system that adds quality to the system?

2. Materials and Methods

The main purpose of this study is to develop a quality measurement framework that provides the current strategic position of HEIs and recommendations for sustainability. A hybrid approach is developed using SWOT analysis with AHP and Entropy. This study highlights the key factors of the universities that have an impact on the quality of higher education reform and discovers the importance of the factors according to the priority needed. The study method involves multiple stepwise strategic planning. Step 1 highlights the factors for the SWOT analysis and categorizes those factors in terms of strengths, weaknesses, opportunities, and threats for the questionnaire survey. Step 2 uses AHP to compare the weighting matrix. Step 3 uses Entropy for objective valuation. Step 4 uses the combined AHP-Entropy method to obtain the results. The last step highlights the key quality factors and suggests important policymaking approaches with the SWOT matrix. The complete workflow is shown in Figure 2.

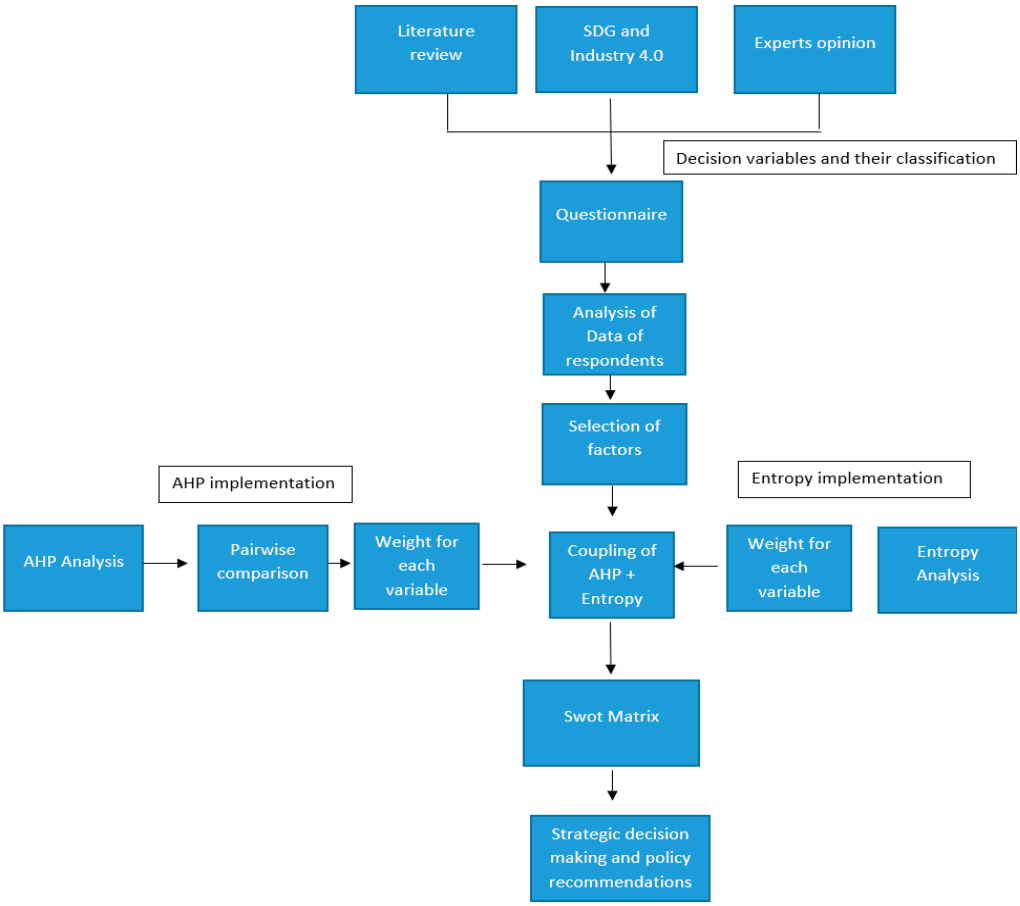

Figure 2. A complete model with stepwise implementation of SWOT with analytic hierarchy process (AHP) and entropy.

2.1. Step 1: Highlighting the Key Factors for SWOT

The adoption of SDG and Industry 4.0 in HEIs involves several factors: collaboration [42], decision-making [43], leadership [44,45], level of freedom [42,46], experts [47–50], budget [47–49], planning [51], skills [52], awareness [52], funding [50,53–55], society [56], etc.

To obtain the important factors, a detailed questionnaire with 40 questions having a key focus on the above issues and a random sampling approach [57] is used for the 350 respondents. Non-random sampling selects samples according to certain subjective criteria, which can make full use of known data, select more typical samples, and make samples better represent the population; it can reduce the sampling scope and robustness of data [58]. Therefore, students (at least 2 years of enrollment), faculty members (at least 3 years of experience), and administration (at least 3 years of experience) of HEIs are selected to complete the questionnaire. All participants were from different departments, including science, arts, commerce, and engineering, and had some knowledge of the current reform of higher education in Morocco and SDGs. Responses to the questionnaire are collected online/offline (paper-based) from different Moroccan universities from January 2020 to April 2020. Of the 350 questionnaires, only 271 responses were obtained, resulting in a response rate of 77%. Approximately 18% of the forms that make up 206 data-filled questionnaires were not included in the data cleaning and normalization of the fields of the questionnaire. The survey's outcomes are indicated in Figure 3.

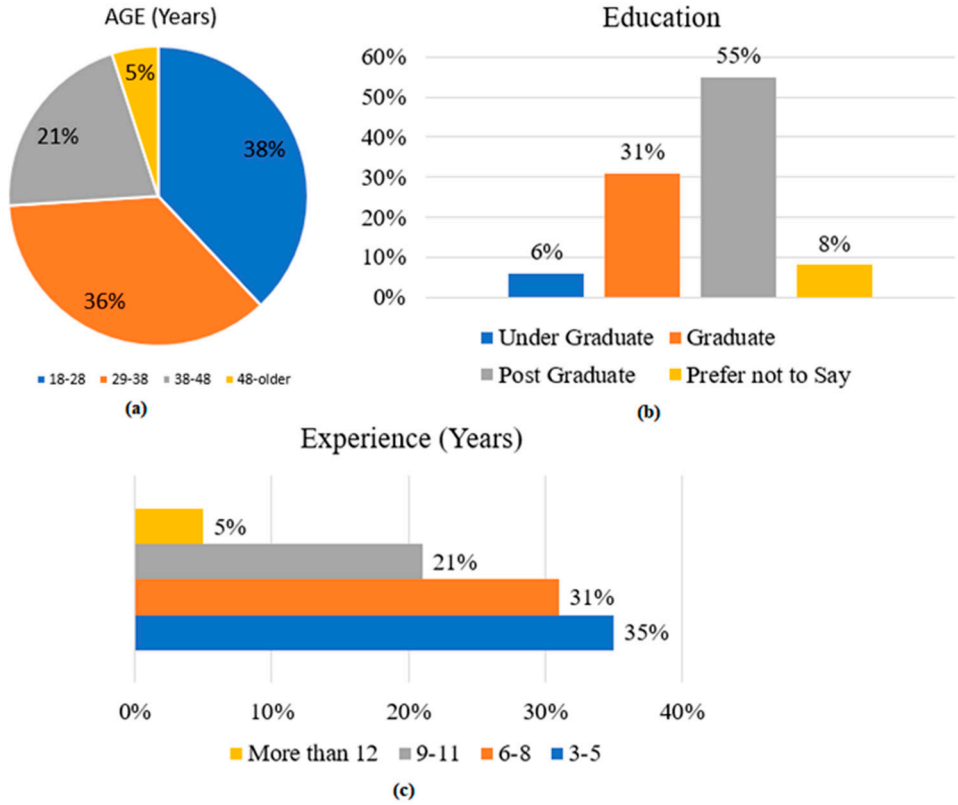

Figure 3. Participants' information (in percentage): (**a**) age-wise, (**b**) academic education, and (**c**) experience.

2.2. Step 2: AHP Analysis

The SWOT methodology involved in this phase employed a methodical assessment and a complete explanation of factors having impact on quality, performance, higher education system monitoring, etc. [59–61] (as shown in Figure 4 sample correlation between different SWOT factors and hierarchy formation).

However, major flaw in SWOT analysis is that it does not help in analyzing the factors in quantitative way. To effectively use the SWOT approach, it can be coupled with the AHP which is a quantitative decision-making method. This method was developed by Professor Thomas L. Saaty [62] to improve decision-making by utilizing the pair-wise factor comparison in a matrix [63].

1. Using the subjective determination method of AHP, the calculation of the weight value λi is specifically divided into four steps:
   - Determine evaluation indicators and establish hierarchical relationships.
   - Each one of the comparison matrices assumes the form (the score uses T. L. Saaty's 1–9 proportional scaling method as shown in Table 2) as shown in Equation (1)

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}, \quad (1)$$

   x_{ij} represents the pairwise comparison rating for hierarchy element i and j ($i = 1, 2, \ldots, m$; $j = 1, 2, \ldots, n$), belong to the same level of the hierarchy X.
   - Calculate the normalized weight vector after normalization using Equation (2):

$$AW = \lambda_{max} W, \quad (2)$$

where λ_{max} is the principal eigenvalue of the matrix X.

- Calculate the weight value λ_i of each index.

$$\lambda_{max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i}, \quad (3)$$

- The deviation from judgment matrix X consistency is expressed by the following equation consistency index (*CI*):

$$CI = \frac{\lambda_{max} - 1}{n - 1}, \quad (4)$$

- The C.R. measures the coherence of the pairwise judgements and is defined by:

$$\text{C.R.} = \frac{C.I}{R.I}, \quad (5)$$

where *R.I* is the average consistency index of the randomly generated comparisons (Table 3).

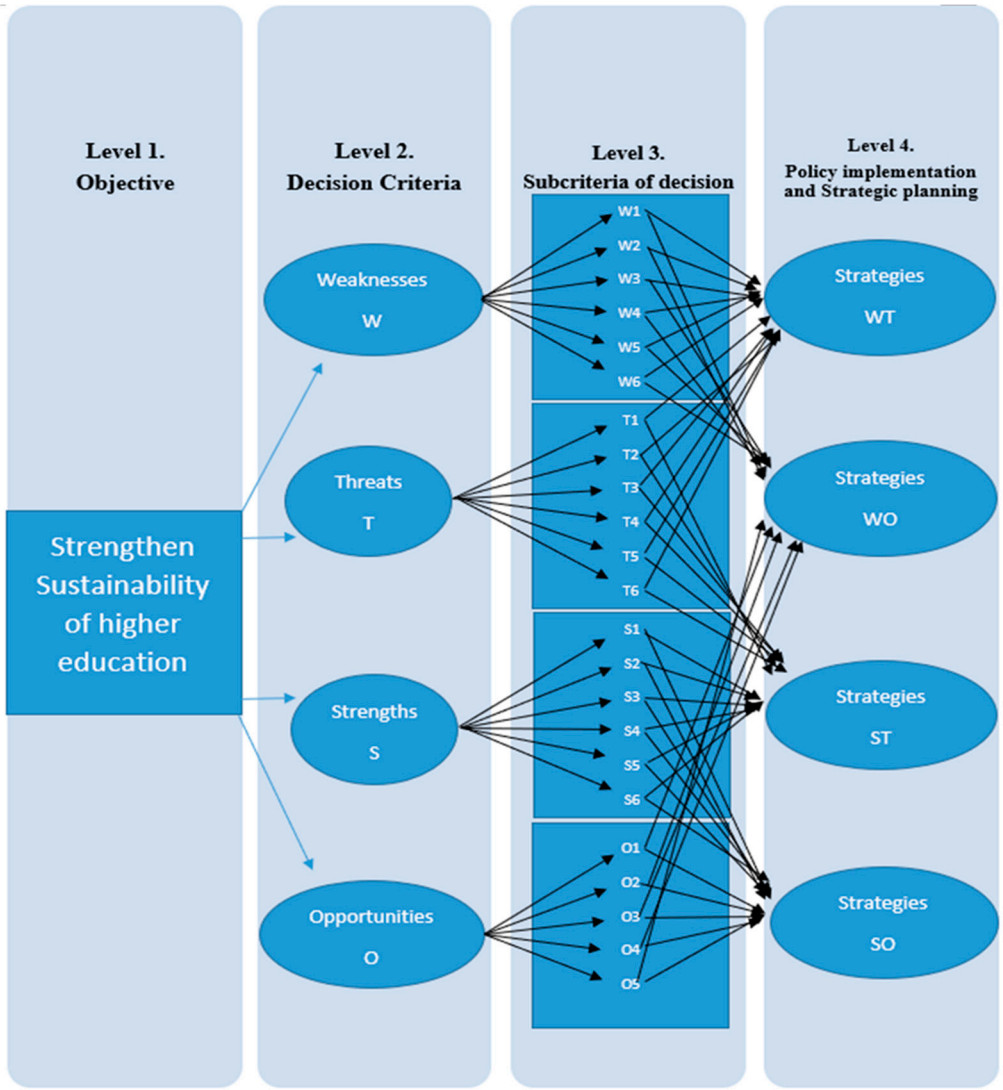

Figure 4. Strategy for using the SWOT analysis in multiple levels.

Table 2. Pairwise comparison scale.

Importance	Explanation
1	Compared with the two elements, the importance is the same
3	Compared with the two elements, the former is slightly more important or advantageous than the latter
5	Compared with the two elements, the former is more important or advantageous than the latter
7	Compared with the two elements, the former is more important or advantageous than the latter
9	Compared with the two elements, the former is absolutely more important or advantageous than the latter
2, 4, 6, 8	Is the middle value between the above scales

Table 3. Random index.

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

2.3. Step 3: Entropy's Analysis

Calculate the weight value based on Entropy's objective weight determination method, W_j, which is specifically divided into six steps:

- Determine the original data scoring matrix $X = (X_{ij})_{m\times n}$ (using T. L. Saaty's 1–9 ratio scale method as shown in Table 2) for evaluating n indicators and m samples through investigation.
- Perform dimensionless processing on the original data scoring matrix as shown in Equation (6):

$$X^*_{ij} = \left(X_{ij} - \overline{X}\right)/\sigma_j \quad (6)$$

- Calculate the proportion P_{ij} of each index as:

$$P_{ij} = X^*_{ij} / \sum_{i=1}^{m} X^*_{ij}, \quad (7)$$

- Calculate the information entropy e_j of each indicator using Equation (8):

$$P_{ij} = (1/\ln(m)) \sum_{i=1}^{m} P_{ij} \ln\left(P_{ij}\right), \quad (8)$$

- Calculate the difference coefficient g_j of each index. The formula is:

$$g_j = 1 - e_j, \quad (9)$$

- Calculate the weight value W_i of each indicator:

$$W_j = \frac{g_j}{\sum_{j=1}^{n} g_j}, \quad (10)$$

2.4. Step 4: AHP-Entropy-Based Comprehensive Coupling Method

Calculate the comprehensive weight value (geometric mean) W^*_j, (flowchart shown in Figure 5):

$$W^*_j = \frac{\lambda_j w_j}{\sum_{j=1}^{n} \lambda_j w_j}, \quad (11)$$

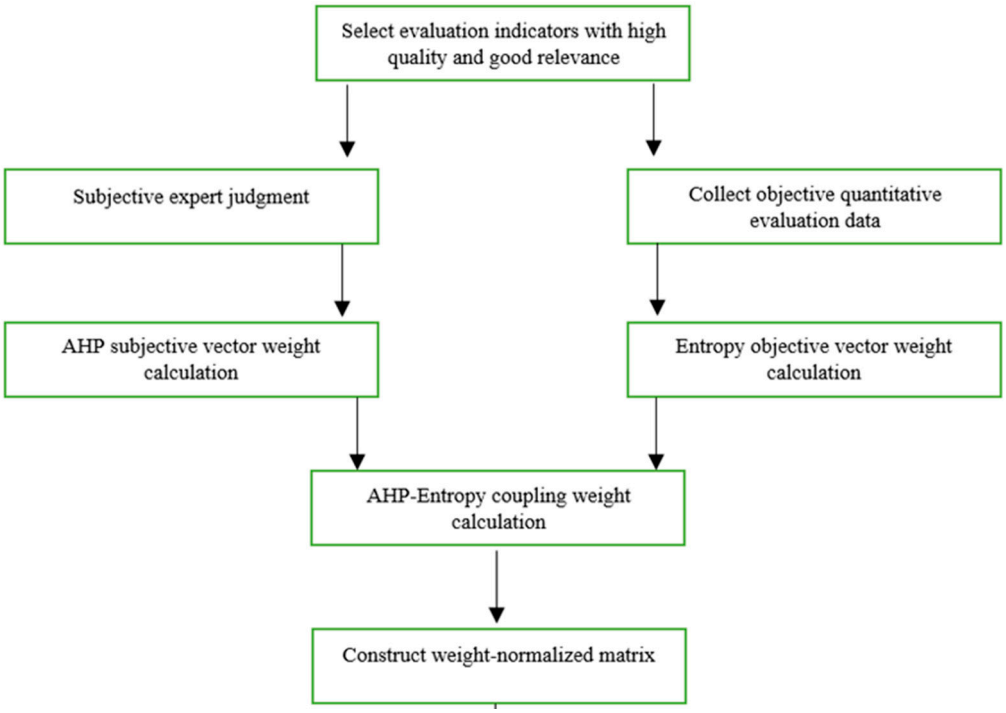

Figure 5. Construction of coupling the AHP with entropy method.

2.5. Step 5: SWOT Matrix for Decision-Making

Using the SWOT with AHP and Entropy analysis, the important factors of SWOT groups within each group can be obtained (Figures 6 and 7). The quadrilateral model could be built based on the priorities of SWOT groups. The priorities are marked in a coordinate system, which stands for S, W, O, and T [64]. Then, by connecting strengths with opportunities and weaknesses with threats, the quadrilateral is formed. Using that quadrilateral from S, W, O, and T factors, the current higher education structure based on the center of gravity can be confirmed [65].

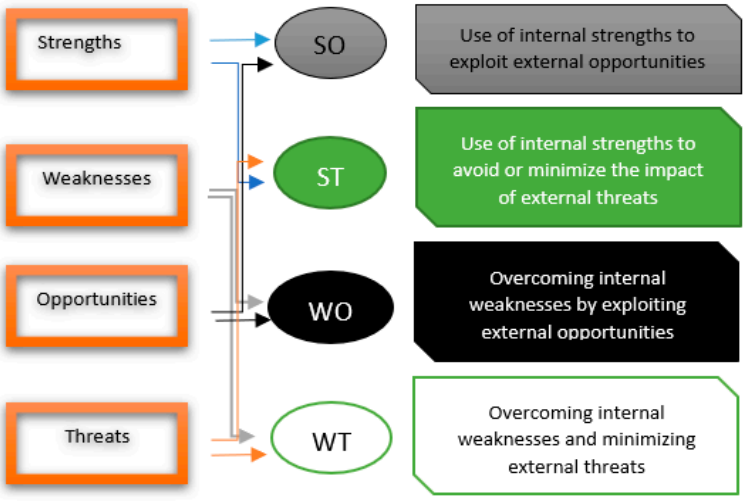

Figure 6. Construction of coupling the AHP with entropy method.

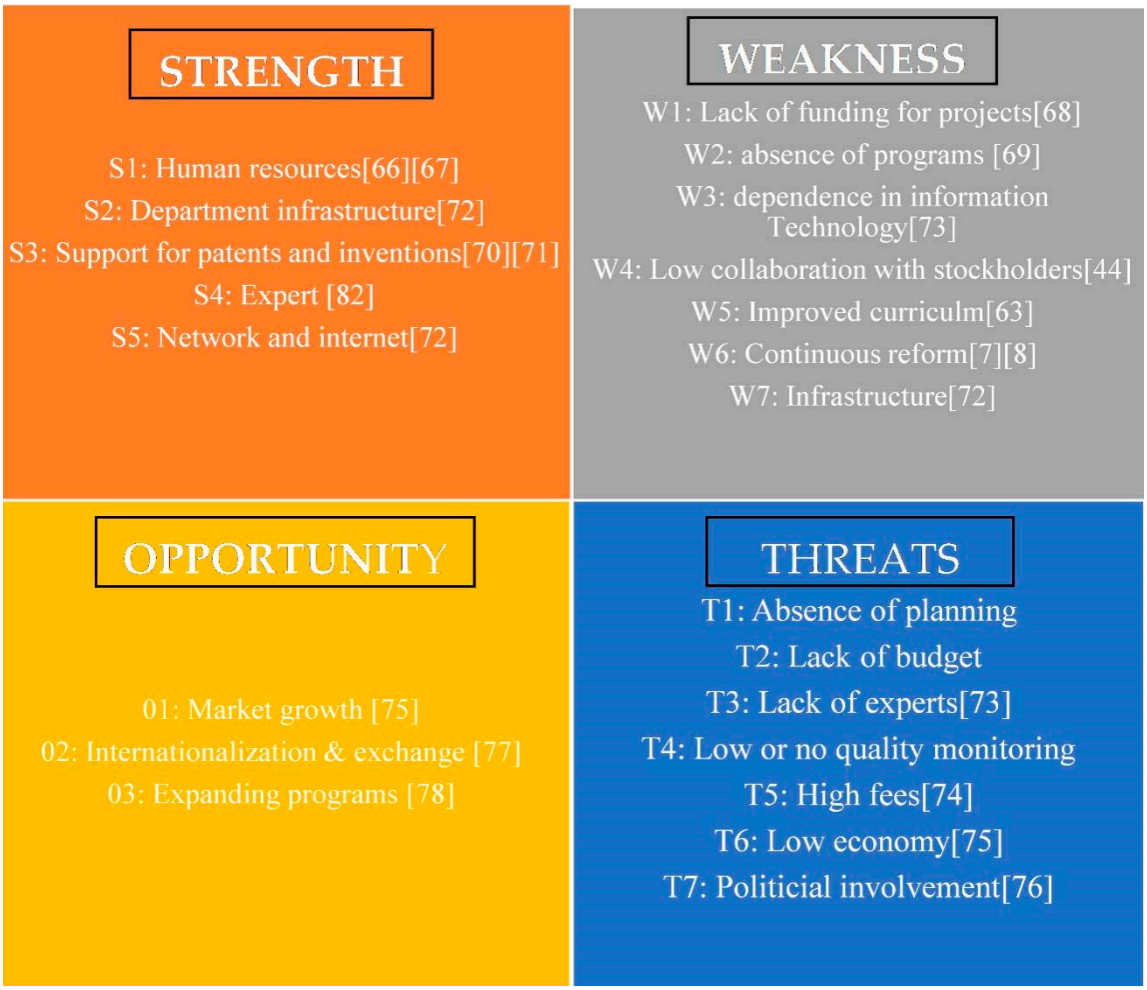

Figure 7. Recognition of strengths, weaknesses, opportunities, and threats.

According to the higher AHP scale above (Table 2), questionnaire data have been collected using the 1–9 scale method [62]. Based on the SWOT factor of Morocco's higher education system, different weights are extracted using AHP. For AHP analysis, this study used the yaahp 10.1 software to calculate the weight (Wi) and the consistency ratio (CR). If CR < 0.1, it has passed the consistency test. All quality factors which are shown in Figure 7 are selected from different studies [66–78] with each factor is highlighted against its study. Otherwise, it has failed. In the decision-making process, it may be necessary to collect questionnaires from many experts [79]; the data provided by the experts may be incomplete. The yaahp software mainly uses the AHP and the fuzzy comprehensive evaluation method to provide model construction, analysis, and calculation functions for the decision-making process. If the incomplete matrix is not acceptable, the ranking weight cannot be executed; it is necessary to complete the calculation of the missing judgment matrix data. At present, it has been widely used in the evaluation of problem processing and has been of great help to users. Pairwise comparisons of the SWOT groups are shown in Table 4.

Table 4. Pairwise comparisons of strengths, weaknesses, opportunities, and threats (SWOT) factors.

SWOT Groups	S	W	O	T	Importance Degrees
Strengths (S)	1.000	3.000	1.000	3.000	0.367
Weaknesses (W)	0.333	1.000	0.250	2.000	0.146
Opportunities (O)	1.000	4.000	1.000	2.000	0.365
Threats (T)	0.333	0.500	0.500	1.000	0.123
CR = 0.06					

All the sub-elements of the SWOT metrics are compared for each group of strengths, weaknesses, opportunities, and threats (Tables 5–8).

Table 5. Comparison matrix of strengths group.

Strengths	S1	S2	S3	S4	S5	Importance Degrees
S1	1.000	0.500	0.200	0.500	0.167	0.057
S2	2.000	1.000	0.167	0.200	0.167	0.065
S3	5.000	6.000	1.000	3.000	2.000	0.400
S4	2.000	5.000	0.333	1.000	0.200	0.144
S5	6.000	6.000	0.500	4.000	1.000	0.334
CR = 0.08						

Table 6. Comparison matrix of weaknesses group.

Weaknesses	W1	W2	W3	W4	W5	S6	S7	Importance Degrees
W1	1.000	3.000	0.200	0.200	0.500	0.250	0.500 0	0.055
W2	0.333	1.000	0.167	0.167	0.500	0.200	0.500	0.035
W3	5.000	6.000	1.000	1.000	6.000	2.000	7.000	0.294
W4	5.000	6.000	1.000	1.000	6.000	2.000	7.000	0.294
W5	2.000	2.000	0.167	0.167	1.000	0.200	0.500	0.056
W6	4.000	5.000	0.500	0.500	5.000	1.000	7.000	0.204
W7	2.000	2.000	0.143	0.143	2.000	0.143	1.000	0.062
CR = 0.06								

Table 7. Comparison matrix of opportunities group.

Opportunities	O1	O2	O3	Importance Degrees
O1	1.000	2.000	3.000	0.539
O2	0.500	1.000	2.000	0.297
O3	0.333	0.500	1.000	0.164
CR = 0.08				

Table 8. Comparison matrix of threats group.

Threats	T1	T2	T3	T4	T5	T6	T7	Importance Degrees
T1	1.000	0.333	2.000	1.000	0.333	0.500	0.500	0.0946
T2	3.000	1.000	1.000	2.000	4.000	3.000	1.000	0.2389
T3	0.500	1.000	1.000	1.000	0.500	1.000	0.333	0.1006
T4	1.000	0.500	1.000	1.000	3.000	1.000	0.500	0.1240
T5	3.000	0.250	2.000	0.333	1.000	0.250	0.250	0.0980
T6	2.000	0.333	1.000	1.000	2.000	1.000	0.333	0.1128
T7	2.000	1.000	3.000	2.000	2.000	3.000	1.000	0.2311
CR = 0.08								

The overall priority scores of the SWOT factors are calculated. Overall priorities are shown in Table 9.

Table 9. Overall priority scores of SWOT factors.

SWOT Group	Group Priority	SWOT Factors	Factor Priority within the Group	Overall Priority of Factor
Strengths	0.367	S1	0.057	0.021
		S2	0.065	0.024
		S3	0.400	0.147
		S4	0.144	0.053
		S5	0.334	0.122
Weaknesses	0.146	W1	0.055	0.008
		W2	0.035	0.005
		W3	0.294	0.043
		W4	0.294	0.043
		W5	0.056	0.008
		W6	0.204	0.030
		W7	0.062	0.009
Opportunities	0.365	O1	0.539	0.197
		O2	0.297	0.108
		O3	0.164	0.060
Threats	0.123	T1	0.095	0.012
		T2	0.239	0.029
		T3	0.101	0.012
		T4	0.124	0.015
		T5	0.098	0.012
		T6	0.113	0.014
		T7	0.231	0.028

Most of the selected indicators are qualitative indicators with greater vagueness. The entropy weight value of each factor as shown in Table 9 was determined using the calculation method of entropy weight. The AHP method established the subjective weight α and conducted the consistency test; the Entropy method determined the objective weight β. For the combination of subjective and objective weights [38], the geometric average method was used [80]; the coupling weight was obtained by the final normalization process. The results with their rank are shown in Table 10.

The weight indicators of the influence of the development of children's football, from large to small, are as follows: O1S3 > S5 > O2 > O3 > S4 > W3 > W4 > W6 > T2 > T7 > S2 > S1 > T4 > T6 > T1 > T3 > T5 > W7 > W1 > W5 > W2.

The four variables, total strength S, total weakness W, total opportunity O, and total threat T, together form a coordinate system [81]. Through the coupling method, the relative importance of the factors involved in the higher education system was developed. According to the above calculation results, the influence of each factor on the development of higher education reform is quite different. To grasp the main factors, we established the greatest importance in the SWOT coordinate axis, namely, S3 = 0.123, W3 = 0.036, O1 = 0.165, and T2 = 0.024, marked the representative results of the total ranking of these levels in the SWOT analysis chart, and connected them accordingly into a quadrilateral, as shown in Figure 8. We denoted the quadrilateral area as D. S and W can be expressed as S(x_1,0) and w($-x_2$,0), while O and T can be expressed as O (0, x_3) and T (0, $-x_4$). The center of gravity P (x, y) can be expressed as:

$$P(x,y) = \left(\frac{1}{A} \int \int_D xdxdy, \frac{1}{A} \int \int_D ydxdy \right), \quad (12)$$

where A is: $A = \int \int_D dxdy = \frac{1}{2}(x_1 + x_2) \frac{1}{2}(x_3 + x_4)$.

Table 10. Overall priority scores of SWOT factors.

SWOT Group	SWOT Factors	Overall Priority of Factor (AHP)	Overall Priority of Factor (Entropy)	Coupled Weights (Rank)
Strengths	S1	0.021	0.0147	0.018 (13)
	S2	0.024	0.0168	0.02 (12)
	S3	0.147	0.1029	0.123 (2)
	S4	0.053	0.0371	0.044 (6)
	S5	0.122	0.0854	0.102 (3)
Weaknesses	W1	0.008	0.0056	0.007 (20)
	W2	0.005	0.0035	0.004 (22)
	W3	0.043	0.0301	0.036 (7)
	W4	0.042	0.0294	0.035 (8)
	W5	0.008	0.0056	0.007 (20)
	W6	0.030	0.021	0.025 (9)
	W7	0.009	0.0063	0.008 (19)
Opportunities	O1	0.197	0.1379	0.165 (1)
	O2	0.108	0.0756	0.09 (4)
	O3	0.060	0.042	0.05 (5)
Threats	T1	0.012	0.0084	0.01 (16)
	T2	0.029	0.0203	0.024 (10)
	T3	0.012	0.0084	0.01 (16)
	T4	0.015	0.0105	0.013 (14)
	T5	0.012	0.0084	0.01 (16)
	T6	0.014	0.0098	0.012 (15)
	T7	0.028	0.0196	0.023 (11)

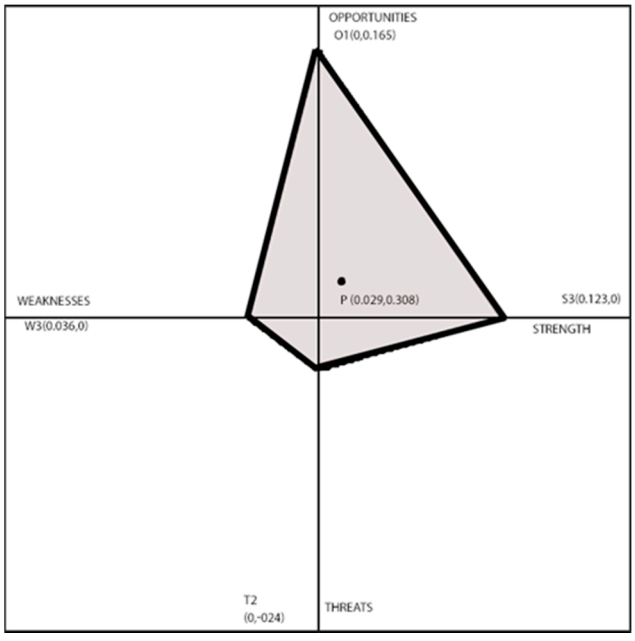

Figure 8. SWOT quadrilateral.

According to the analysis, we can get the center of gravity (x,y) with the Formulas (13) and (14)

$$X = \frac{1}{2}(x_1 - x_2), \quad (13)$$

$$Y = \frac{1}{2}(x_3 - x_4)\, 1A \int\int D, \quad (14)$$

The coordinates of the center of gravity of the calculated strategic quadrilateral are P(X, Y) = (0.029, 0.308). The center of gravity P is in the first part, indicating that the higher

education system must focus on the key strengths and opportunities (SO) to improve higher education and to develop sustainable higher education reform. The higher education system should use its internal strength to increase more opportunities.

Although the Moroccan government has made some progress in expanding the scale of higher education, improving the higher education system, and promoting higher education to meet the needs of social and economic development, the level of development of Moroccan higher education is at the forefront of African countries [82]. However, due to historical and practical reasons, there are still many problems that need to be resolved in the development of Moroccan higher education. Since entering the 21st century, Moroccan basic education has made significant progress in terms of enrollment, but the drop-out and repetition rates in Moroccan primary and secondary schools, as well as the adult illiteracy rate, are still high. These factors directly affect higher education [83]. The quality of student resources has severely restricted the development of higher education. The high unemployment rate of Moroccan university graduates has seriously affected the realization of the function of higher education in promoting economic and social growth. According to the statistics from the Moroccan High Planning Commission, unemployment is continuously increasing, and the rate is 3.3% in 2019 as compared to last year. This rate is higher in Moroccan urban areas as compared to rural areas. In 2020, 3.8% increase in unemployment as compared to 2019 in major cities [84].

The contradiction between the rapid growth of Moroccan higher education enrollment and the quality assurance of higher education has become increasingly prominent. Although the gross enrollment rate of Moroccan higher education is relatively low, the number of Moroccan higher education enrollment has shown a continuous increase since the beginning of the 21st century. Like many developing countries, the expansion of Moroccan higher education has also led to a decline in the quality of education. According to the data provided by the 2013–2014 Global Competitiveness Report (The Global Competitiveness Report) [85], among the 144 countries that participated in the evaluation, Morocco ranked 102nd in terms of quality of education and 104th in terms of quality of higher education and training systems. An important reason for the low quality of Moroccan higher education is that many schools use financial subsidies mainly to expand enrollment rather than improve the quality of education. Due to the lack of competition among Moroccan universities, some higher education institutions are content with the low standard of education and are unwilling to change [86]. Of the budget funds used for the growth of higher education, more than 85% are used for current expenditures and only 0.5–1% is used for school staff training. The huge expenditures for education have been unsatisfactory in return [87].

Another significant problem is language. The language of teaching conflict in Moroccan higher education still needs to be resolved. Morocco has been a historically multilingual country. The main languages spoken in the country are Arabic, French, Berber, English, and Spanish [88]. The Moroccan government implemented an Arabic language policy immediately after the country became independent. To increase opportunities, language issues need to be addressed so that more international universities pay attention to the Moroccan education system. Although the Moroccan government has put forward a diversified teaching language policy in the National Education and Training Regulations, the abovementioned problems have not been effectively resolved. The teaching language problem is still an important factor affecting the development of higher education in Morocco.

Quality development of higher education is one of the major issues in Morocco higher education. Quality development mainly refers to the improvement of quality of research and innovations. Quality innovation is in contrast to quality control, problem prevention, error reduction, and maintenance of the status quo, emphasizing the discovery of strengths, the improvement of learning ability, and the expansion of value. The main points of higher education quality innovation include: product design and planning innovation, pursuit of continuous quality improvement, identification and innovation of educational needs, emphasis on comprehensive services, emphasis on the effective operation of the quality system, and emphasis on the role of people. Morocco higher education quality innovation

mainly includes educational product innovation, educational technology innovation, educational process innovation, educational management innovation, and educational system innovation.

All the factors outlined in this study are truly important for the reform of higher education and a sustainable economic model. Other research and experts also highlight the same factors, but this study concentrated on the priorities of the factors and used an improved hybrid decision-making model. This model is helpful in decision-making for the government, stakeholders, education reform departments, and other HEIs in Morocco. Further, in future, this decision-making model can be compared with other latest models like standard deviation [89] and coefficient of similarity ranking to make decision-making more useful.

3. Conclusions

This study is focused on the goal of education for sustainable development in higher education to incorporate the principles, values, and practices of sustainable development into all aspects of higher education and to build a more sustainable future for future generations in terms of environmental integrity and economic feasibility. This study used the SWOT model to aid decision-makers to highlight key quality factors in higher education. Almost all the criteria factors discussed in this research are important for the success of the reform and the achievement of the SDGs. Using the calculated priorities of SWOT factors may be developed as a management strategy or support for critical decision-making. The fusion of AHP and Entropy helped to improve decision-making for both the government and policymakers. This study has several important results and can be further expanded using different multicriteria decision-making (MCDM) models. The findings in our study are helpful for strategy makers to design and implement a long-term plan in higher education. Future research could be more useful if combined with fuzzy multicriteria models for decision-making and in-depth development of questionnaire from the experts or using latest MCDM models like COMET (Characteristic objects method) or SPOTIS.

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