Materiality Assessment of Key Issues for Sustainability Management and ISO 26000 by Extent Fuzzy AHP Approach: Analysis of A University Case

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Abstract

ISO 26000 is an International Standard providing guidance on social responsibility of organizations. For a successful ISO 26000 implementation organizations need to identify and prioritize the key issues for sustainability management that have the most significance to organization and their stakeholders. This paper proposes a fuzzy analytic hierarchy process, integrating the fuzzy logic and analytic hierarchy process, to support organizations in assessing materiality of key issues relating to sustainability management practice. A case study is performed to demonstrate the applicability of the proposed approach. It is expected that this study could be useful to organizations in preparing for sustainability management and ISO 26000 implementation.

Keywords: *Sustainability Management, ISO 26000, Materiality, Fuzzy, Analytic Hierarchy Process, Extent Analysis*

1. Introduction

ISO 26000 is an international standard, developed by the International Organization for Standardization (ISO), that provides guidance on social responsibility for all types of organizations in society, including corporations, governments, and NGOs. It outlines the requirements that all organizations should adhere to regarding seven core subjects: governance, human rights, labor practices, environment, fair operating practices, consumer issues, and community involvement and development. ISO 26000 emphasizes the transparent reporting of an organization's social responsibility performance to both internal and external stakeholders within the context of sustainable development (ISO 26000, 7.5, Box 15). Organizations that currently publish sustainability reports based on the Global Reporting Initiative (GRI) guidelines are also incorporating ISO 26000 into their reports. For an ISO 26000 social responsibility report to be reliable, it should effectively address the interests of stakeholders and encompass significant issues relevant to the organization (ISO 26000, 7.6.2). Therefore, it is crucial for organizations to prioritize and address the issues that are significant to them within the framework of ISO 26000.

In the materiality assessment step of ISO 26000 for deriving significant issues, it is necessary to determine which social responsibility issues are considered most important

by stakeholders within the organization. The Analytic Hierarchy Process (AHP), which is a representative methodology for resolving such problems, is a multi-criteria decision-making technique that hierarchically structures various evaluation factors constituting a decision problem and determines the relative importance and prioritization of these factors through pairwise comparisons (Saaty, 1980). However, in the process of pairwise comparison in AHP, it is necessary for decision-makers to express their importance or preference for evaluation factors in linguistic terms and assign corresponding appropriate numerical values. In practice, it is difficult for decision-makers to explicitly judge their subjective preferences as a single specific numerical value. The resulting ambiguity and uncertainty in evaluations impose significant limitations in contexts that require accurate decision-making.

Therefore, in this study, the Fuzzy AHP method, which combines the conventional AHP with fuzzy set theory to effectively handle the uncertainties inherent in decision makers' subjective value judgments, is applied to derive the importance and priority of key issues related to sustainability management practice at a case university. To this end the paper first briefly reviews the structure and core themes of ISO 26000, then presents the results of a case study conducted using the Fuzzy AHP method, and finally discusses the implications of the research findings and directions for future research.

2. Literature Review

2.1. Social Responsibility Standard ISO 26000

ISO 26000, published on November 1, 2010, is the first international standard on social responsibility that applies to organizations of all types, in both the public and private sectors, regardless of their size, industry, or location. According to the definition in ISO 26000, social responsibility means the responsibility of an organization for the impacts of its decision and activities on society and the environment, through transparent and ethical behavior. ISO 26000 has expanded the discourse on social responsibility, which had previously been focused on companies, to all organizations that make up society.

Figure 1 provides a schematic overview of ISO 26000, illustrating the standard's clauses and their interrelationships, which help organizations comprehend the standard. As depicted in Figure 1, ISO 26000 is organized into several clauses that provide guidance on social responsibility concepts and definitions, principles, recognizing social responsibility and engaging stakeholders, the core subjects and issues of social responsibility, integrating social responsibility throughout an organization, and the relationship of social responsibility with sustainable development.

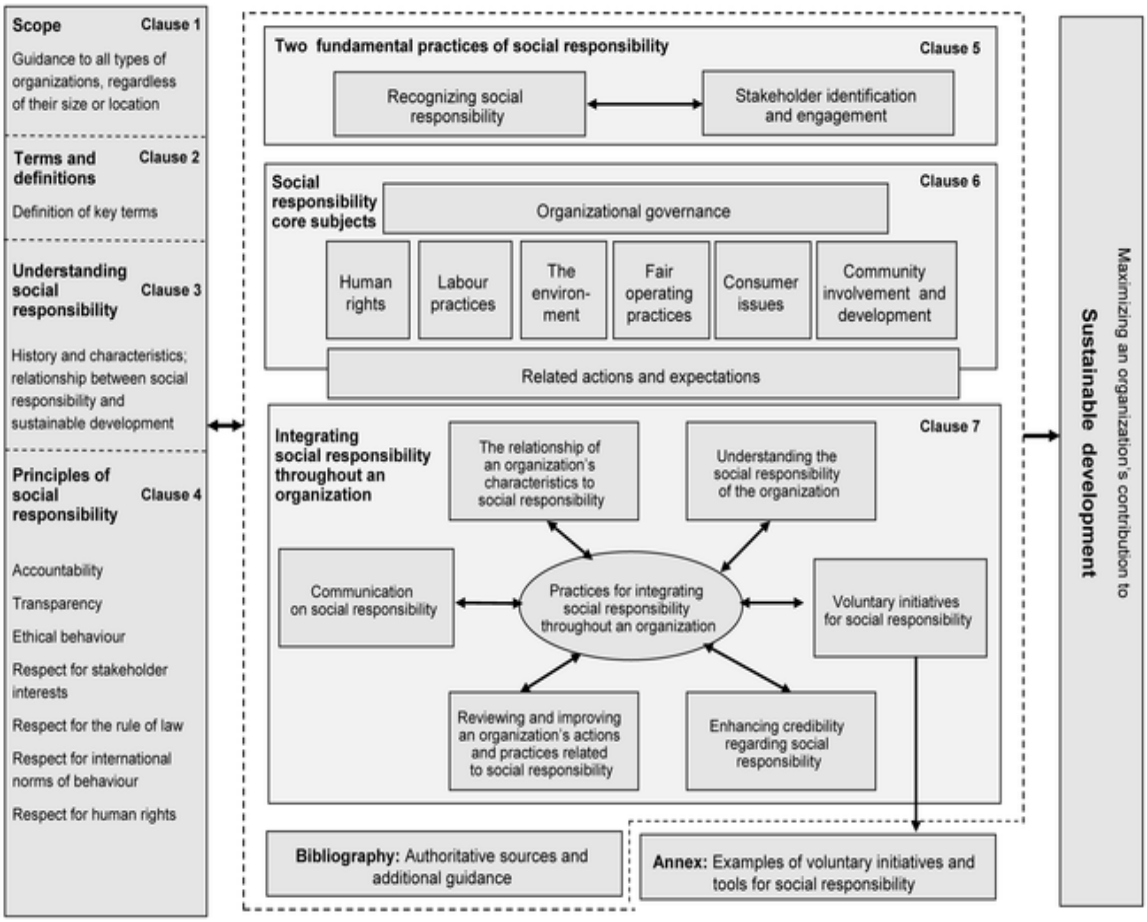


Figure 1. Schematic overview of ISO 26000 (www.iso.org)

The core subjects and issues outlined in ISO 26000 are fundamental areas that organizations should consider when addressing their social responsibility. These subjects include organizational governance, human rights, labor practices, the environment, fair operating practices, consumer issues, and community involvement and development. Each of these core subjects includes a variety of issues, and organizations can decide for themselves how important or relevant the issues are to the organization by communicating with stakeholders. Table 1 shows the seven different core subjects of ISO 26000 and their corresponding issues for social responsibility.

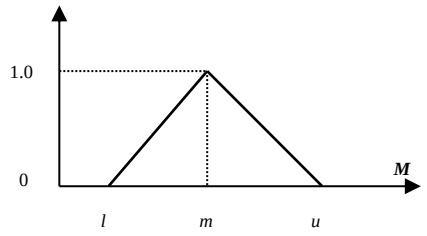
In line with this, the Korean Agency for Technology and Standards (2012) enacted KS A ISO 26000:2012 to promote social responsibility. The Korean Standards Association (2013) then developed and distributed the ISO 26000 implementation level diagnostic checklist. ISO 26000 checklist includes the process for the implementation of the social responsibilities and the result assessment for 7 core subjects. This self-assessment of social responsibility process and achievements enables organizations to align their practices with the requirements outlined in ISO 26000.

Table 1. Core subjects and issues of social responsibility

Core Subjects	Issues	Addressed in sub-clause
Organizational Governance	1. Organizational Governance	6.2
Human Rights	1. Due diligence 2. Human rights risk situations 3. Avoidance of complicity 4. Resolving grievances 5. Discrimination and vulnerable groups 6. Civil and political rights 7. Economic, social and cultural rights 8. Fundamental principles and rights at work	6.3.3 6.3.4 6.3.5 6.3.6 6.3.7 6.3.8 6.3.9 6.3.10
Labour Practices	1. Employment and employment relationships 2. Conditions of work and social relationships 3. Social dialogue 4. Health and safety at work 5. Human development and training in the workplace	6.4.3 6.4.4 6.4.5 6.4.6 6.4.7
Environment	1. Prevention of pollution 2. Sustainable resource use 3. Climate change mitigation and adaptation 4. Protection of the environment, biodiversity and restoration of natural habitats	6.5.3 6.5.4 6.5.5 6.5.6
Fair Operating Practices	1. Anti-corruption 2. Responsible political involvement 3. Fair competition 4. Promoting social responsibility in the value chain 5. Respect for property rights	6.6.3 6.6.4 6.6.5 6.6.6 6.6.7
Consumer Issues	1. Fair marketing, factual and unbiased information and fair contractual practices 2. Protecting consumers' health and safety 3. Sustainable consumption 4. Consumer service, support, and complaint and dispute resolution 5. Consumer data protection and privacy 6. Access to essential services 7. Training and awareness-raising	6.7.3 6.7.4 6.7.5 6.7.6 6.7.7 6.7.8 6.7.9
Community Involvement and Development	1. Community involvement 2. Training and culture 3. Employment creation and skills development 4. Technology development and access 5. Wealth and income creation 6. Health 7. Social investment	6.8.3 6.8.4 6.8.5 6.8.6 6.8.7 6.8.8 6.8.9

2.2. Fuzzy AHP and Extent Analysis

The AHP, introduced by Saaty (1980), is one of the commonly adopted methods used in determining the relative importance of a set of attributes or criteria. Many researchers have applied the AHP to solve multiple criteria decision-making problems in a number of different areas such as engineering design, economic planning, energy policy, project selection, budget allocation, etc. (Madzík and Falát, 2022; Jose and Thomas, 2022). However, the standard AHP is often criticized for its inability to precisely handle the inherent uncertainty or vagueness associated with the mapping of the decision-maker's judgment to a number (Chan and Kumar, 2007). In many practical cases, the decision-maker could be imprecise about their own level of preference due to incomplete information or knowledge, the vagueness of human thinking, and the inherent complexity and uncertainty of the decision environment. Therefore, it is difficult for the decision-maker to express pairwise comparison judgments as exact numerical values on a ratio scale. To mitigate this limitation, it is more natural to express the comparison ratios as interval numbers or fuzzy sets since they can better represent uncertain human judgments. For this reason, this study applies a fuzzy modification of the AHP, the fuzzy AHP, to determine criteria weights, which use triangular fuzzy numbers as shown in Figure 2.



$$\mu(x/\tilde{M}) = \begin{cases} 0, & x < l, \\ (x-l)/(m-l), & l \le x \le m, \\ (u-x)/(u-m), & m \le x \le u, \\ 0, & x > u \end{cases} \quad (1)$$

Figure 2. Triangular fuzzy number, $\tilde{M}$

Triangular fuzzy numbers are defined by three real numbers, expressed as (*l*, *m*, *u*). The parameters *l*, *m*, and *u*, respectively, indicate the smallest possible value, the most promising value, and the largest possible value that describe a fuzzy event. Their membership functions are described as equation (1). The linguistic scale and corresponding triangular fuzzy numbers are provided in Table 2.

Table 2. Linguistic scale and corresponding triangular fuzzy numbers

Fuzzy number	Linguistic scale	Triangular fuzzy scale
$\tilde{1}$	Equally important	(1, 1, 1)
$\tilde{3}$	Weakly important	(2, 3, 4)
$\tilde{5}$	Fairly important	(4, 5, 6)
$\tilde{7}$	Strongly important	(6, 7, 8)
$\tilde{9}$	Absolutely important	(9, 9, 9)
$\tilde{2}$, $\tilde{4}$, $\tilde{6}$, $\tilde{8}$	Intermediate values ($\tilde{x}$)	$(x-1, x, x+1)$
$1/\tilde{x}$	Triangular fuzzy reciprocal scale	$(1/(x+1), 1/x, 1/(x-1))$

In this study the extent fuzzy AHP method is utilized, which was originally introduced by Chang (1996). The main steps of fuzzy extent analysis conducted in this study are as follows (Soh, 2006, 2018):

Step 1: The value of fuzzy synthetic extent with respect to the i^{th} object is defined as

$$S_i = \sum_{j=1}^{m} M_{ij} \otimes \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1} \quad (2)$$

where $\sum_{j=1}^{m} M_{ij} = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j \right)$, $\sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} = \left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i \right)$, and $\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i} \right)$.

Step 2: As $\tilde{M}_1 = (l_1, m_1, u_1)$ and $\tilde{M}_2 = (l_2, m_2, u_2)$ are two triangular fuzzy numbers, the degree of possibility of $M_1 = (l_1, m_1, u_1) \geq M_2 = (l_2, m_2, u_2)$ defined as:

$$V\left(\tilde{M}_1 \geq \tilde{M}_2\right) = height(\tilde{M}_1 \cap \tilde{M}_2) = \mu_{M_1}(d) = \begin{cases} 1, & if \quad m_1 \geq m_2 \\ 0, & if \quad l_2 \geq u_1 \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & if \quad m_2 \geq m_1 \end{cases} \quad (3)$$

Step 3: The degree possibility for a convex fuzzy number to be greater than *k* convex fuzzy M_i *(i=1, 2,…, k)* numbers can be defined by

$$V(M \geq M_1, M_2, ..., M_k) = V\left[(M \geq M_1) \ and \ (M \geq M_2) \ and ... and \ (M \geq M_k)\right]$$
$$= \min \ V(M \geq M_i), \quad i = 1, 2, ..., k \quad (4)$$

Step 4: Assume that $d(X_i) = \min V(S_i \geq S_k)$ for $k = 1, 2, ..., n; k \neq i$. Then the weight vector is given by $W' = (d'(X_1), d'(X_2), ..., d'(X_n))^T$ where $X_i = (i = 1, 2, ..., n)$ are *n* elements. Via normalization, the normalized weight vectors are

$$W = (d(X_1), d(X_2), ..., d(X_n))^T \quad (5)$$

where *W* is a non-fuzzy number.

3. Empirical applications and discussion

This study identifies significant issues in the implementation of ISO 26000, with a focus on a university case, and analyzes the importance and priority of these key issues by applying the fuzzy AHP method.

3.1. Identification of key issues for sustainability management

Wonkwang University is the first Korean university to obtain the highest grade in the implementation level of ISO 26000 social responsibility from the Korean Standards Association. The university selected key issues for sustainability management in

compliance with the materiality testing procedure recommended by the GRI Standards and ISO 26000 Guidelines, as presented in Figure 3.

Figure 3. Materiality Assessment Process (Wonkwang University Sustainability Report, 2018)

A relevance assessment identified 64 sustainability management issues through internal and external environmental analysis and extensive interviews with the university's stakeholders. A materiality assessment then selected 17 of these issues as being the most important to the university. As shown in Table 3, the key issues for sustainability management at the case university were classified into four categories: Education, Research, Operations & Governance, and External Leadership.

Table 3. Key issues for sustainability management

Categories	Key Issues
Education	1. Implementation of the National Education Program 2. Reinforcement of Student Learning Capacity 3. Cultivation of Global Talents 4. Diverse and Extensive Scholarship Programs 5. Enhancement of Education Quality
Research	1. Securing Faculty to Foster Future Leaders 2. Establishment of R&D Environment 3. Studies for the Future Generation 4. Creation of a Safe Research Environment
Operations & Governance	1. Transparency of University Financial Management 2. Strengthening University Management Capacity 3. Anti-corruption and Transparent Management 4. Counseling and Support System
External Leadership	1. Start-up and Employment Program 2. Creation of Social Values of University 3. Green Campus

3.2. Analysis of materiality and priority of key issues

In order to analyze the relative importance and priority of the sustainable management issues identified above, a survey was conducted on the internal and external stakeholders of the university. A questionnaire for pairwise comparison of the identified issues was developed, and the university's stakeholders were asked to compare the relative importance of four categories (the criteria) and their corresponding key issues (the sub-criteria) using a nine-point linguistic scale. Then, the linguistic evaluations of each respondent were converted to triangular fuzzy numbers in accordance with Table 2. A total of 31 questionnaires were collected. After excluding those with a consistency ratio exceeding 15%, the remaining 26 questionnaires were analyzed using Microsoft Excel.

The results derived from the fuzzy AHP analysis are presented in Table 4. These results indicate that in aiming for sustainable management, the case university should concentrate on the area of ‘Education’ which is the subject with the highest priority weight (32.1%) among the four considered categories. On the other hand, ‘Research’ is considered the least relevant area for sustainable management at the case university.

The local weights in Table 4 represent the relative importance that was assigned by the university's stakeholders to each key issue within its corresponding category. In the Education category, the ‘Implementation of the national education program for university development’ is considered to be the most important issue, followed in order of importance by ‘Reinforcement of student learning capacity’, ‘Enhancement of education quality’, ‘Diverse and extensive scholarship programs’, and ‘Cultivation of global talents’. Moreover, ‘Securing faculty to foster future leaders’, ‘Strengthening university management capacity’ and ‘Start-up and employment program’ are classified as the most important issues in the Research, Operations & governance and External leadership categories, respectively.

To examine the priority ranking of the key issues, the global weight is calculated by multiplying the local weight of each key issue with the weight of its associated category, as presented in the last column of Table 4. After calculating the global weights, all the key issues are rearranged in descending order of priority, as shown in Figure 4. The overall ranking of the global weights shows that the ‘Start-up and employment program’ is ranked as the most important issue for sustainable management of the case university. The key issues ‘Creation of social values of university’, ‘Enhancement of education quality’, ‘Strengthening university management capacity’, and ‘Transparency of university financial management’ are the next ones to be prioritized.

Table 4. Relative importance (weight) of key issues

Categories	Weights	Key Issues	Local weights	Global weights
Education	0.321	Implementation of the National Education Program	0.311	0.100
		Reinforcement of Student Learning Capacity	0.208	0.067
		Cultivation of Global Talents	0.095	0.030
		Diverse and Extensive Scholarship Programs	0.148	0.047
Research	0.165	Enhancement of Education Quality	0.238	0.076
		Securing Faculty to Foster Future Leaders	0.323	0.053
		Establishment of R&D Environment	0.253	0.042
		Studies for the Future Generation	0.199	0.033
Operations & Governance	0.241	Creation of a Safe Research Environment	0.225	0.037
		Transparency of University Financial Management	0.283	0.068
		Strengthening University Management Capacity	0.295	0.071
			0.247	0.060
			0.175	0.042
External Leadership	0.273	Anti-corruption and Transparent Management	0.463	0.126
		Counseling and Support System	0.338	0.092
		Start-up and Employment Program	0.199	0.054
		Creation of Social Values of University		
		Green Campus		

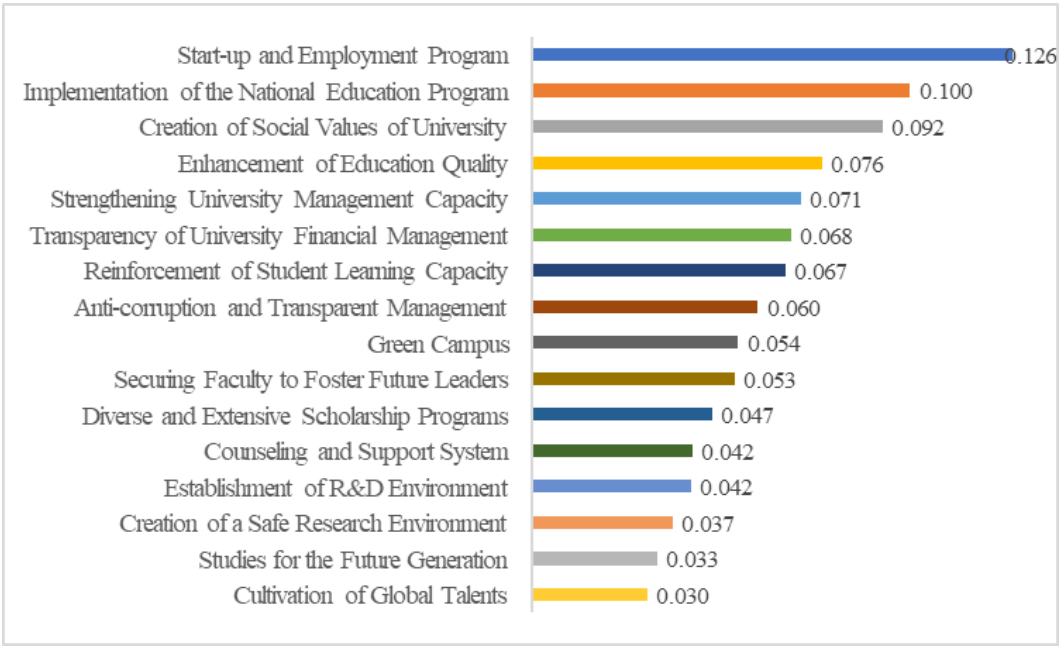


Figure 4. Priority weights of key issues for sustainability management

4. Conclusions

Organizations can use the guidance in ISO 26000 to develop their own sustainability management system. In the context of ISO 26000, materiality analysis is used to identify the key issues that are most relevant to an organization's sustainability management. However, there is still a lack of methodical approach to determine material issues. Therefore, this study proposes fuzzy AHP method to identify and prioritize the key issues for sustainability management. An empirical case study is presented to demonstrate application of the proposed approach. Although, the single case limits generalization of the study it suggests that further research on this topic should be conducted.

Acknowledgments

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