International Journal of
Organizational Innovation

A STUDY ON THE CRITICAL SUCESS FECTORS FOR CORPORATION NET-ZERO EMISSIONS AND SUSTAINABLE DEVELOPMENT

Liang, Shuo-Era,
Hsu, Hsiang-Chen,
Lin, Huan-Chang
Department of Industrial Management, I-Shou University, Taiwan
Allen780608@gmail.com

Abstract

From global warming to global boiling, greenhouse gas emissions impact climate change, and the world must take action to ensure the sustainability of the Earth. Achieving net-zero greenhouse gas emissions by 2050 is a global consensus and a goal shared by 153 countries. This paper analyzes the current challenges faced by the corporate sector in implementing net-zero emissions and sustainable development through a Life Cycle Assessment (LCA) approach, focusing on five areas: raw material design, cultivation and training, manufacturing and production, waste recycling, and logistics transportation. Recommendations are provided for each of these areas.

This paper targets companies that have conducted organizational greenhouse gas inventories and researchers in related fields. A combined qualitative and quantitative research method is applied. The qualitative method uses the Analytic Hierarchy Process (AHP) to explore the five critical success factors of Life Cycle Assessment. A questionnaire with 23 key issues was developed through expert interviews. The quantitative analysis was conducted through a survey of 60 corporate leaders, key managers, and academic experts from both domestic and international companies.

The results were statistically analyzed using expert weighting to determine the ranking of the five key success factors.

The value of this study lies in the comprehensive collection of opinions from companies currently implementing net-zero emissions. According to the weighted statistical ranking, raw material design ranked first, highlighting the challenges faced in managing the source of products. The study concludes with policy recommendations, including green supply chains and raw material management, innovation in raw material processing technologies and R&D support, the establishment of green raw material certification systems, carbon emission caps and regulations, financial and market support, international cooperation, and policy alignment. These recommendations aim to guide government agencies in implementing policies for emission reduction, waste reduction, carbon footprint, low-carbon production, carbon-negative technologies, carbon credits, carbon trading, and carbon neutrality, ultimately enhancing international competitiveness.

Keywords: Net-Zero Emissions and Sustainable Development, Greenhouse Gas Inventory, Critical Success Factors, Analytic Hierarchy Process (AHP), Carbon Footprint.

Introduction

In 1999, the United Nations called on global companies to comply with the "Global Compact" initiative, which focuses on improving human rights, labor conditions, environmental protection, and anti-corruption measures (Zhi-Lun Chen, 2022). In 2000, the UN introduced the "Millennium Development Goals" (MDGs), which set out eight targets, including the eradication of poverty and hunger, universal primary education, gender equality, reduction of child mortality, improvement of maternal health, combating diseases like HIV/AIDS and malaria, ensuring environmental sustainability, and fostering global partnerships (Ting-Chi Yang, Chia-Jen Chen, Chu-Hsi Hsu, 2024). In 2015, the UN established 17 "Sustainable Development Goals" (SDGs) addressing economic, social, and environmental protection (Chia-Huei Wu, 2024), aiming to tackle global challenges with a target for achievement by 2030 (Mao-Wen Lin, 2022). At the 21st Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, the Paris Agreement was signed, requiring countries to reach carbon neutrality by 2050 in order to avoid climate deterioration. As of 2023, 153 countries have agreed to this goal. Multinational corporations are moving even faster, with a goal of achieving carbon neutrality by 2030 under international agreements and trade mechanisms (Yon-Ah Wang, 2024). Cheng-guo Li and Fang-yi Liao (2010) used Game Theory to explore the effects of corporate green responsibility behavior. The research showed that establishing market differentiation and selection mechanisms could lead to effective ways for corporate green responsibility behaviors, addressing the externalities of corporate actions.

Corporate Social Responsibility (CSR) was first advocated by UN Secretary-General Kofi Annan in 1999, urging companies to implement CSR practices. Companies should not only focus on monetary profits (Xing-Chi Wei, 2024; Tong-Sun, 2024) but also take responsibility for their supply chains, shareholders, labor employees, and the environment, contributing positively to society. ESG stands for Environmental protection, Social responsibility, and Governance (Han-Xue Wang, Xiao-Rui Li, Ke-Xin Wang, Yi-Fan Man, 2024). ESG originates from the United Nations' 2004 "Who Cares Wins" report. The report proposed that companies should integrate ESG criteria into their operational evaluation metrics, which could have a positive impact on society, financial markets, and personal investment portfolios (Hsiang-Hsuan Chih, Wen-Chuan Miao, Yun-Jie Lu, 2024). ESG not only promotes sustainable business practices but also brings positive benefits to society, the environment, and the economy, while effectively fulfilling corporate social responsibilities.

Literature Review

The concept of Critical Success Factors (CSFs) was first defined by Daniel (1961), who believed that most industries typically have 3 to 6 factors that determine success, and for a business to succeed, it must focus on excelling in these key factors. Henderson (1988) defined CSFs as elements that are essential for a business or organization to achieve success in its operations (Wei-Kuan Yeh, 2023). Based on this, since businesses and organizations have limited resources, they must allocate them optimally to achieve success. In 1979, John F. Rockart named this approach the Critical Success Factor (CSF) method in the *Harvard Business Review* and defined CSF as "a small number of areas, the results of which, if they meet the requirements, will ensure the organization’s success and competitive performance" (Zheng-da Jiang, Yi-wen Wang, 2014). Therefore, the critical success factors that are vital for the operation of a business or organization today may not necessarily retain the same level of importance in the future. Companies and organizations must possess flexibility and competitiveness to adapt to environmental changes and ultimately achieve success. This study adopts both quantitative and qualitative research to explore the critical success factors of business operations. The research methods used are the Analytic Hierarchy Process (AHP) and the Expert Investigation Weight Method (EWM).

Analytic Hierarchy Process (AHP) The Analytic Hierarchy Process

(AHP) is a decision-making support method developed by Saaty (1977). It quantifies complex problems based on the decision-maker's judgments using a scale, building a factor hierarchy structure, and evaluating alternative solutions. The method emphasizes the importance of intuitive judgment by decision-makers and the consistency of comparisons between alternatives (Saaty, 1977; Saaty, 1994).

Expert Investigation Weight Method (EWM)

Bao et al. (2013) proposed the Expert Investigation Weight Method, which involves inviting experts to assess the importance of various factors using a Likert scale (1 to 5). The scores given by the experts for each factor's importance are then summed to determine the overall importance of each factor. In this study, the implementation of the "Expert Investigation Weight Method" focuses on the importance ratings between various factors. The goal is not only to distinguish between the "high" and "low" importance of factors but also to determine the proportional relationships in their importance. Using "mathematical induction, " it is proven that when the ratings of the factors are the same, the factor with the greatest variance in its ratings has the lowest importance.

Research Model

If the primary goal is to pursue economic growth, product design and manufacturing should follow the "Cradle to Grave" thinking, which involves five aspects: training and development, raw material design, process and production, logistics and transportation, and waste recycling treatment. These five elements represent the product manufacturing process and its recycling cycle. The research model differentiates between questionnaire design and target selection, followed by the execution of Expert Investigation Weight Method (EWM) analysis.

Questionnaire Design and Subject Selection

This study uses Critical Success Factors as the basis for analysis, focusing on key success elements that affect a company's net-zero sustainability throughout the product lifecycle, including training, raw material design, processes and production, logistics and transportation, and waste recycling. Five key frameworks for the overall study are proposed. The questionnaire review experts include business leaders and managers with practical experience in the industry. Additionally, 60 participants, including domestic and international industry professionals, managers, scholars, and field experts, are selected to complete and provide feedback on the questionnaires.

Expert Investigation Weight Method

3. 2. 1 Matrix A

Invite k experts to assess the importance of m variables and create an importance relationship matrix A.

$$[A] = \begin{pmatrix} a11 & a12 & \dots & a1m \\ a21 & a22 & \dots & a2m \\ \dots & & & \\ ak1 & ak2 & \dots & akm \end{pmatrix}$$

Matrix Calculation

By dividing each element in the j-th row of matrix A by the corresponding elements in the i-th row, similar m "relative importance" matrices (A1, A2, . . . , Am) can be derived. The sum of the elements in each row k of these m matrices will yield B1, B2, . . . , Bm rows.

$$[A1] = \begin{pmatrix} a_{11}/a_{11} & a_{12}/a_{11} & \dots & a_{1m}/a_{11} \\ a_{21}/a_{21} & a_{22}/a_{21} & \dots & a_{2m}/a_{21} \\ \vdots & & & \\ a_{k1}/a_{k1} & a_{k2}/a_{k1} & \dots & a_{km}/a_{k1} \end{pmatrix}$$

$$\{B1\} = \{ b11 \quad b12 \quad \dots b1m \}$$

Next, the rows B1, B2, . . . , Bm are arranged sequentially to form the following matrix B:

$$[B] = \begin{pmatrix} B_1 \\ B_2 \\ \\ B_m \end{pmatrix} \begin{matrix} = \\ = \\ \\ = \end{matrix} \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1m} \\ b_{21} & b_{22} & \dots & b_{2m} \\ \dots & & & \dots\dots \\ b_{m1} & b_{m2} & \dots & b_{mm} \end{pmatrix}$$

The first row elements of matrix B are obtained by dividing the first row elements of matrix A by the sums of the other rows. The data for the other rows follow in a similar manner. Each element bij represents the ratio of the importance between the i-th and j-th variables. The value brj indicates the extent to which the r-th variable is "dominated" by the j-th variable. A larger brj means that the j-th variable is more important than the r-th variable.

The Role of Matrix B

Traditionally, when evaluating the importance of each item, the comparison is based on the sum of the elements in each row of matrix A. The items with the largest total score are considered the most important. However, this simple calculation can lead to situations where the total scores of different items are the same, making it difficult to compare their relative importance.
To accurately compare the importance of each item, the "item scores" must be divided by the "total scores of all items. " This results in matrices B1, B2, . . . , Bm. By summing the rows of these matrices and merging them, matrix B is obtained. Summing the columns of matrix B and applying a standard normalization process provides the weights for each item. This allows for a clear ranking of the relative importance of each item.

Date Analysis and Results

Questionnaire Design and Feedback

Expert Background

This study's questionnaire consists of 5 dimensions and 23 items (as shown in Table 1). The questionnaire participants were pre-selected, with the condition that their organization must be involved in ESG (Environmental, Social, and Governance) practices or net-zero emissions, or they must be scholars engaged in related research. The questionnaire was distributed via an online survey method to ensure efficiency and accurate statistical analysis. A total of 60 experts were selectively chosen, with age distribution as follows: 2 individuals (3%) aged 25-35, 4 individuals (3. 7%) aged over 60, 13 individuals (23. 3%) aged 36-45, and 42 individuals (70%) aged over 45. All participants were senior managers or experts in net-zero emissions, with 78. 3% holding managerial positions or above. Their extensive experience, along with their experience in implementing net-zero emissions policies, was essential for ensuring the credibility of the questionnaire results.

Questionnaire Statistics

The first stage of the questionnaire used a Likert scale to ensure that all respondents answered under the same conditions, ensuring data consistency and increasing the reliability of the research results. In the second stage, to avoid expert bias, the responses from 60 experts were normalized by dividing each by the first expert's weight. This created a baseline set of weights for further comparison. The third stage involved converting the data to a 100-point scale, which allowed for more detailed and refined analysis of the responses. The scores ranged from 0 to 100, offering a more precise evaluation for comparing the importance of various indicators. (Table 2)

Table 1: Expert Questionnaire

Item
1. Training and Development
1-1 Do you agree that excessive greenhouse gas emissions stem from corporate governance policies?
1-2 Do you agree that climate disasters are primarily caused by excessive greenhouse gas emissions?
1-3 Regarding the "2050 Net-Zero Emissions" policy, what is your organization currently (or will be in the future) implementing?
1-4 Do you remain optimistic about "Net-Zero Emissions" given that the government has encouraged corporate greenhouse gas reductions and enacted "Climate Change Response Law"?
1-5 Do you believe that training programs are crucial for raising awareness of "Net-Zero Emissions"?
1-6 Do you believe that it is very important for colleagues in your organization to have knowledge and skills related to "Net-Zero Emissions" for overall operations?
1-7 Does your organization have planned training and certification programs related to "Net-Zero Emissions"?
1-8 Do you desire more knowledge and training related to "Net-Zero Emissions"?
2. Raw Material Design
2-1 Is using renewable raw materials crucial to achieving "Net-Zero Emissions"?
2-2 When selecting raw materials, do you prioritize sustainability and environmental impact?
2-3 What proportion of the raw materials you use come from sustainable sources?
3. Processes and Production
3-1 Do you have a mechanism to monitor emissions during production processes?
3-2 How important do you think improving production processes is in reducing emissions?
3-3 Are you actively using low-carbon technologies and eco-friendly methods in production?
3-4 Do you think long-term adoption of low-carbon production technologies will reflect profit growth, comply with government regulations, and align with global trends?
4. Logistics and Transport
4-1 Do you think selecting low-carbon transportation methods aligns with profitability in overall

company operations?
4-2 Do you consider the carbon emissions impact in logistics processes?
4-3 Is using low-carbon transport feasible for your company?
4-4 Do you remain optimistic about government subsidies for zero-emission vehicles in future transportation?
5. Waste Recycling
5-1 In waste management (including liquid, solid, and gaseous waste), do you prioritize recycling and reuse?
5-2 Does your organization have a waste management plan?
5-3 How significant do you think strengthening waste recycling is in achieving net-zero emissions?
5-4 Do you hold a positive view of future government policies on recycling management?
Thank you for participating in the survey. Your feedback will help promote net-zero emissions-related strategies and practices!

Table 2: Conversion of the First Expert's Scores to a 100-Point Scale

Item	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	2-1	2-2	2-3	3-1
First Expert Baseline	70	92	10	32	65	90	90	92	72	75	78	25
Item	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	5-4	
First Expert Baseline	68	90	91	25	90	91	24	12	62	15	50	

In the fourth stage, the baseline scores from the first expert on the 100-point scale were multiplied by the weights of the other 59 experts. The scores from the other experts were then converted from the Likert scale to the 100-point scale.

Questionnaire Analysis

Dimension Analysis

For the five dimensions—training and development, raw material design, processes and production, logistics, and waste recycling—an overall statistical sum of each item was calculated, and the mean score for each dimension was derived by dividing by the number of items. The five dimensions' mean scores were:

- Training and Development = 4027. 394 (as shown in Table 3)
- Raw Material Design = 4357. 5 (as shown in Table 4)
- Processes and Production = 3787. 825 (as shown in Table 5)
- Logistics = 3404. 275 (as shown in Table 6)
- Waste Recycling = 3592. 458 (as shown in Table 7).

Table 3: Training and Development Mean Score

Training and Development								
Item	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8
Score	4270	4655. 2	2180	3632	4468. 75	4374	3708	4931. 2
Total	32219. 15							
Mean	32219. 15/8=4027. 394							

Table 4: Raw Material Design Mean Score

Raw Material Design			
Item	2-1	2-2	2-3
Score	4698	4650	3724. 5
Total	13072. 5		
Mean	13072. 5/3=4357. 5		

Table 5: Processes and Production Mean Score

Processes and Production				
Item	3-1	3-2	3-3	3-4
Score	2337. 5	4250	4032	4531. 8
Total	15151. 3			
Mean	15151. 3/4=3787. 825			

Table 6: Logistics Mean Score

Logistics				
Item	4-1	4-2	4-3	4-4
Score	2687. 5	4140	4149. 6	2640
Total	13617. 1			
Mean	13617. 1/4=3404. 275			

Table 7: Waste Recycling Mean Score

Waste Recycling				
Item	5-1	5-2	5-3	5-4
Score	3120	3456. 5	3180	3983. 333
Total	14369. 83			
Mean	14369. 83/4=3592. 458			

Weight Analysis Comparison

The total scores for the five dimensions were 4027. 394, 4357. 5, 3787. 825, 3404. 275, and 3592. 458, respectively. Dividing each by the total sum of 19169. 45 yields the following weight ratios:

- Training and Development = 0. 210094
- Raw Material Design = 0. 227315
- Processes and Production = 0. 197597
- Logistics = 0. 177589
- Waste Recycling = 0. 187405

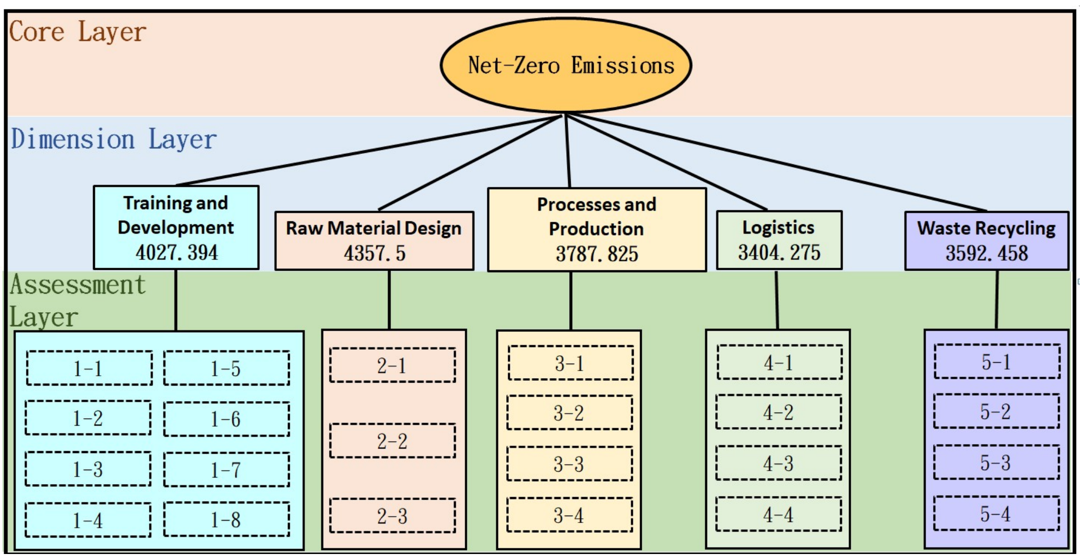

Figure 1: AHP Hierarchical Analysis Diagram of this Study

Table 8: Expert Weight Ranking Statistic

Item	Training and Development	Raw Material Design	Process and Production	Logistics and Transportation	Waste Recycling
Total	4027. 394	4357. 5	3787. 825	3404. 275	3592. 458
Grand Total	19169. 45				
Weight Ratio	0. 210094	0. 227315	0. 197597	0. 177589	0. 187405
Ranking	2	1	3	5	4

Conclusions and Suggestions

Conclusions

Based on the expert weight method, the expert survey results were analyzed to determine the ranking and proportions. According to Chapter 4 (Table 4-10), the two aspects of material design and training were ranked as the 1st and 2nd priorities in the product lifecycle, respectively. The calculated rankings also show these two aspects in the top two, with both accounting for more than 20%. This demonstrates that business owners (or managers) are most concerned with material design and training. The calculated ranking differences between these two aspects were 1. 7%, 1. 2%, 1%, and 1. 1%, with the highest difference of 1. 7% observed between material design and training. This clearly indicates the importance of "material design" in the source management of achieving net-zero emissions.

Recommendations

When developing the "Source Management" policy for achieving net-zero emissions, the government should focus on reducing emissions at the source and encourage industries to fundamentally control emissions. This requires not only strengthening the monitoring and management of carbon emissions, but also achieving long-term and sustainable emission reduction targets through multiple measures, such as promoting technological innovation, changing industrial structures, and encouraging the recycling of raw materials. When designing policies to promote net-zero emission raw materials, the government, as a policy-making body, needs to establish the core objectives of the policy and provide specific guidance and support for the decarbonization process of materials (e. g. , cement, steel, chemicals). Below is a possible policy design framework:

A. Carbon Pricing and Incentives

A carbon tax should be imposed on industries with higher carbon emissions, particularly those in the intermediate raw materials sector, and businesses should be encouraged to participate in carbon markets. This can be achieved by purchasing carbon quotas or carbon credits to reach carbon neutrality. For companies adopting low-carbon technologies, direct financial subsidies or tax incentives should be offered to further encourage investment in green technologies and innovation. For example, a manufacturing plant's carbon emissions can be used as the baseline for carbon inventory. When companies update equipment or improve processes to reduce emissions, they can obtain carbon credits through government-certified organizations, which will be recognized as the company’s carbon rights.

B. Technological Innovation and R&D Support

The government should consider establishing a dedicated carbon reduction technology research and development fund to support the development and commercialization of new technologies (such as carbon capture and storage technology, low-carbon manufacturing processes, etc.). It should set subsidy qualifications and standards for different industries (e. g. , manufacturing, services, and finance) to promote technological exchange and cooperation among various sectors. Additionally, the government should establish industry-university-research alliances to promote the joint application of innovative technologies.

C. Carbon Emission Cap Regulations and Laws

Carbon emission caps should be set for industries, and penalties or additional costs should be imposed on companies that fail to meet the targets. Green certificates and other incentive measures should be provided. Companies should be required to disclose emission data, undergo independent verification, and ensure the transparency and effectiveness of policy implementation.

D. Green Supply Chains and Raw Material Management

Encourage the development of carbon emission standards for raw material suppliers, incentivizing upstream suppliers to adopt emission reduction measures and reduce carbon emissions at the source. Recycling and regeneration standards should be established to encourage the recycling of waste materials in the raw material industry, thus reducing dependence on new raw materials.

E. Financial and Market Support

The government should support the issuance of green bonds and funds to provide dedicated funding for low-carbon technological innovation and green projects. Low-interest loans or risk guarantees should be offered to companies seeking to transition to low-carbon models to reduce their financial pressures.

F. International Cooperation and Policy Coordination

Provide low-carbon skills training for businesses and workers to support industrial transformation. Enhance public understanding of net-zero emissions and stimulate consumer demand for green products, thereby driving market transformation.

Reference

Bao, C. P. , Lee, Y. P. , & Chen, C. Y. (2013). Enhancement of quality function deployment based On Chinkless-Teaching concept design courses. *The International Journal of Organizational Innovation*, 63.

Chen-Kuo Lee, Fang-Yi Liao (2010). "A Game Analysis for Corporate Green Responsibility, " Environmental Management Research, Volume 11, Issue 2, 1-20.

Chih-Lun Chen (2022). Policy recommendations for Taiwan's industries to implement the blueprint for sustainability in the post-epidemic era*, 22, 1-30.*

Daniel, D. W. (1961). Management Information Crisis. *Havard Business Review, 39,* 111- 121.

Hanxue Wang, Xiaorui Li, Kexin Wang & Yifan Man. (2024). Empirical Study on ESG Investment Preferences of Social Security Fund Holdings. Frontiers in Economics and Management, Volume 5 Issue 11, 2024, 196-212. DOI: 10. 6981/FEM. 202411_5(11). 0020

Hsiang-Hsuan Chih, Wen-Chuan Miao& Yun-Jie Lu. (2024). Management Review, Vol. 43 (Oct 2024), 133-153.

Saaty, T. L. (1994). *Fundamentals of decision making and priority with the analytic hierarchy process*. RWS Publications.

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of mathematical psychology*, *15*(3), 234-281.

Ting-Chi Yang, Chia-Jen, &Chen, Chu-Hsi, Hsu. (2024), An Investigation of Sustainable Development Goals in Hospitality Higher Education – A Case Study of Taiwan and Hong Kong, International Journal of Management and Organization (IJMO), 2024, 2(4), 1-16. DOI: https://doi. org/10. 30209/IJMO. 202402. 009

Tong Sun. (2024). Research on the Mechanism of Green Transformation of Manufacturing Industry Enabled by Digital Economy. Frontiers in Economics and Management, Volume 5 Issue 11, 2024, 178-185. DOI: 10. 6981/FEM. 202411_5(11). 0018

Wei-Kuan Yeh(2023). A Study on the key Success Factors of Knowledge Management Innovation in the Technology industry. *The Journal of Chinese Public Administration, No. 33*, pp. 101-110, DOI:10. 6712/JCPA. 202312_(33). 0005.

Xingchi Wei. (2024). CSR Information Disclosure, Market Competition and Commercial Credit Financing. Frontiers in Economics and Management, Volume 5 Issue 12, 2024, 75-86. DOI: 10. 6981/FEM. 202412_5(12). 0009

Yonah Wang. (2024). The Gatekeeper Behind Accreditation Mechanisms—TAF, Supporting Net-Zero Transition and Enhancing Industrial Competitiveness. WindTAIWAN, 2024 June, 135-139.

Zheng-da Jiang, Yi-wen Wang (2014). "The Research of Conceptual Framework of Integrating Key Successful Factors for Place Marketing, " National Education, 54(5), 31-43.