Research on the Establishment Principle and Comprehensive Treatment of Sustainable University Evaluation System under Double Carbon Background

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Abstract
In the context of dual carbon emissions, the comprehensive evaluation system of universities is the focus of the sustainable university construction process. Therefore, by integrating the existing sustainable university evaluation system at home and abroad, on the basis of data processing and application, this paper applies the database and campus information system to campus governance and university construction, and deeply explores the effective way of combining sustainable university construction and computer network technology. It provides theoretical support and construction ideas for the construction of sustainable universities in China under the background of dual carbon emissions.

Keywords*: sustainable university, double carbon, data processing*

1. INTRODUCTION

To achieve the carbon peak before 2030 and carbon neutrality before 2060 (hereinafter referred to as the “ double carbon ” target) are major strategic plans made by the Party Central Committee after careful consideration, and are also a solemn commitment of world significance to deal with climate change. At present, China has put carbon peak and carbon neutralization into the overall layout of ecological civilization construction. The proposal of ' double carbon ' goal will promote the construction of China ' s green development road, and will become one of the themes of China ' s future social and economic development. University is an important institution to deal with sustainable issues and promote energy conservation and emission reduction, and it is also a high energy consumption institution for tens of thousands of people. It has an unshirkable responsibility to promote the realization of the “double carbon” goal and avoid the threat of global warming to future generations [1].

However, the research on the sustainable university system in China is still relatively small, and the practice of sustainable development is mainly concentrated in the stage of adapting to the national green development strategy. In order to promote universities to meet the higher requirements of sustainable university construction under the " dual carbon " goal, this paper will sort out the existing evaluation framework and evaluation index system of sustainable university construction, and provide scientific theoretical basis for the sustainable development of universities under the dual carbon strategic goal. This will open up a good start for the evaluation system of sustainable university construction and provide improvement direction for relevant practice. Compared with the existing literature, the innovation of this paper is to sort out the existing literature from the perspective of " dual carbon, " better fit China 's national conditions, and provide theoretical basis for the construction of sustainable evaluation system of Chinese universities under the background of dual carbon.

2. MATERIALS AND METHODS

In terms of definition, sustainable universities refer to 'universities that choose to commit themselves to sustainable development' [10]. That is to say, the sustainability factors that are integrated into the mission of university construction and the development plan [11] are incorporated into the operation, research and education of universities [7]. The construction activities have special financial support and staffing, and the above

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factors are incorporated into the daily operation of universities by providing organizational and management guarantees and establishing sustainable development governance structures [5]. Universities at home and abroad have carried out relevant practices, such as the 'Smart Key Laboratory Building' [3] of Newcastle University in the United Kingdom and Osaka University in Japan for building energy monitoring and energy saving strategies [12]. Relevant domestic practices mainly include the green university construction practice carried out by Tsinghua University in 1998 [6] and the green university construction started by Tongji University in 2003.

In the continuous development process, the international sustainable evaluation system has experienced a long-term update and development, so far there are ten kinds of evaluation system. Among them, the United States mainly leads and evaluates climate change and low carbon development through greenhouse gas emissions and energy performance indicators, and Europe mainly leads and evaluates climate change and low carbon development through carbon reduction and carbon management performance indicators. At the same time, domestic scholars have also conducted a series of studies on green universities. Zhu Bifeng studied the adaptability of STARS to Chinese green campus [14], and Fachrudin proposed green building standards for Chinese green campus [2].

At present, foreign system research has a long history, more practice cases, relatively more perfect. At the same time, due to different national conditions at home and abroad, for example, domestic universities are public universities, and foreign systems cannot be directly used in China. But the functions of universities at home and abroad (education, research, social participation, operation) are the same. Therefore, this paper will sort out the indicators from the perspective of university function. At the same time, the sustainable construction of university has influence on itself, city, talent industry and international. Sustainable universities have the most profound and direct impact on universities themselves. Education can cultivate talents with sustainable ideas and green knowledge and technology; scientific research can promote scientific and technological progress and promote industrial transformation and upgrading; through operation, universities can become a unified coordinator of green development; through social participation, universities can connect with society and promote high-quality development of society as a whole. So this article will also sort out indicators from the scope of impact.

3. RESULTS & DISCUSSION

Lozano studied the existing higher education sustainability assessment tools, and found that these tools did not make a clear assessment of the core functional education and scientific research of universities, and focused on the environmental level, but ignored the economic and social level. In order to put forward a more perfect university sustainability assessment system, he chose GRI as the basis for the construction of the evaluation system. On the basis of GRI ' s economic, environmental and social dimensions, he added the education dimension for the core competitiveness of universities, and proposed the Graphical Assessment of Sustainability in Universities (GASU) [8]. The education dimension of GASU is constructed from four aspects of education, scientific research, operation and social participation, including 24 indicators. By scoring each index from 0-4 and generating charts, GASU intuitively shows the sustainable efforts of schools and provides tools for comparison between universities. GASU directly uses GRI related indicators to evaluate dual carbon from indirect economic impact, energy, emissions, environmental compliance. GASU contains 8 secondary indicators, including 1 education level, 2 research level, 5 social participation level and 1 operation level. From the scope of influence, there are 1 campus level, 6 cities, and 1 talent industry level.

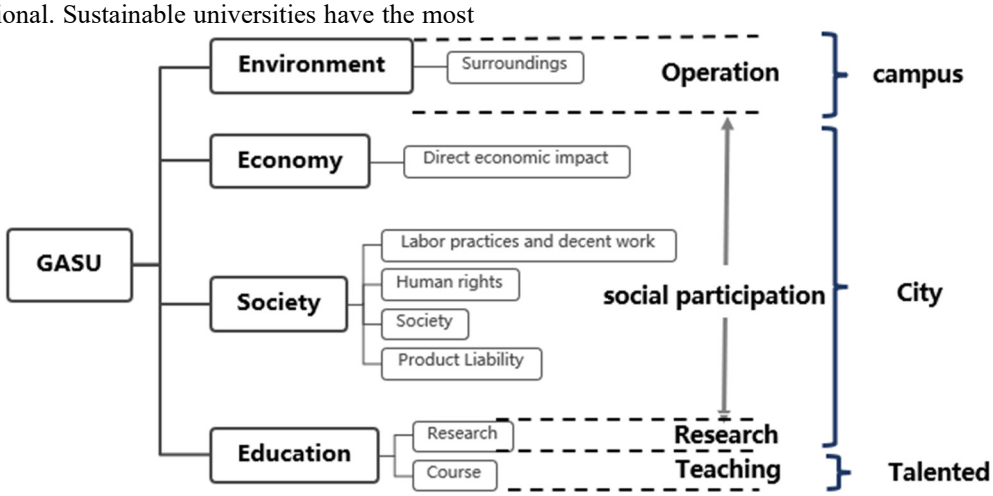

Figure1. he Graphical Assessment of Sustainability in Universities (GASU)

The Sustainability Tracking Assessment and Rating System (STARS) is an evaluation system proposed by the Association for the Advancement of Sustainability in Higher Education (AASHE), and is one of the most popular evaluation systems. STARS2.2 evaluates the university ' s sustainable efforts from four dimensions: academic, participation, operation, planning and management, and encourages schools to innovate to promote sustainable development by adding additional innovation credits. The dual carbon is evaluated by air and climate, energy, procurement, transportation and waste indicators. Through online self-rating, STARS guides the way forward for universities that have just begun sustainable construction and encourages universities to continue to move forward. STARS contains 17 secondary indicators, including 1 education level, 1 research level, 1 social participation level and 14 operational level. From the scope of influence, there are 14 campus level, 2 city level and 1 talent industry level.

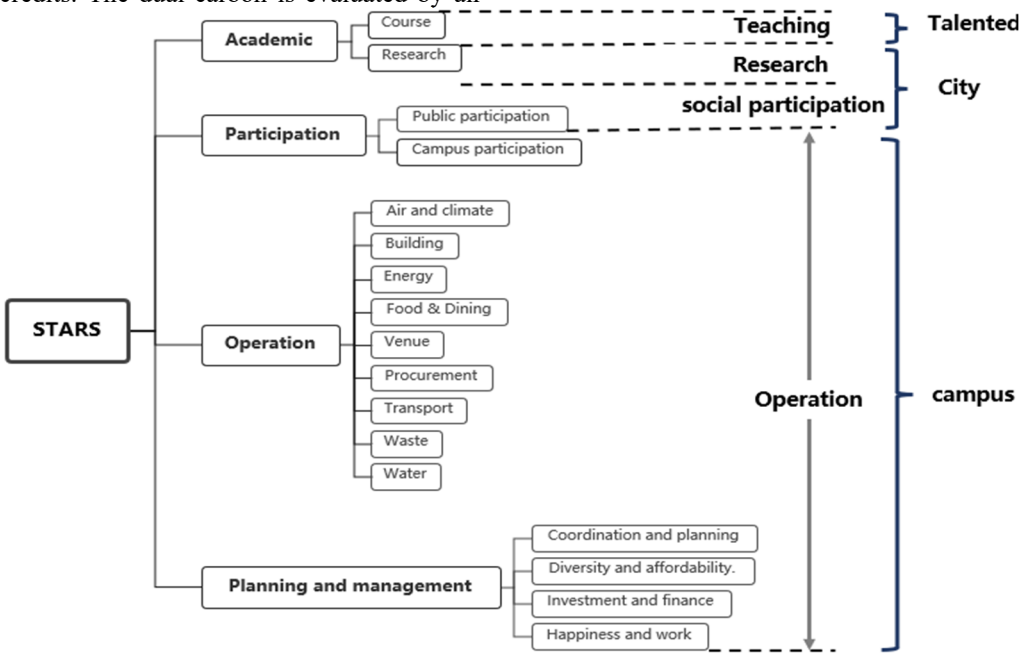

Figure 2. The Sustainability Tracking Assessment and Rating System (STARS)

Suresh Jain et al. believe that there is a lack of systematic and continuous assessment of campus sustainability, and general sustainable campus assessments tend to focus only on measures to improve institutional sustainability, without highlighting the GHG list of institutions. Based on this understanding, the author proposes the Assessment of Carbon Neutralization and Sustainability in Higher Education Campuses (CaNSEC) [4], a sustainability assessment system for university campuses, which evaluates and compares universities of different structures by using standardized indicators commonly used in educational institutions. CaNSEC evaluates the sustainable construction of campus by calculating the carbon footprint and sustainability, promotes the sustainable construction of campus, and provides experience and help for backward schools. CaNSEC calculates the campus carbon footprint from five aspects of energy, waste, water supply and carbon sink, and then evaluates the construction of campus dual carbon. The CaNSEC sustainability dimension includes 4 secondary indicators and 23 tertiary indicators, including 1 secondary indicator at the education and research level, 2 social participation level and 1 operational level; from the scope of influence, there are 1 campus level, 2 cities, 1 talent industry level.

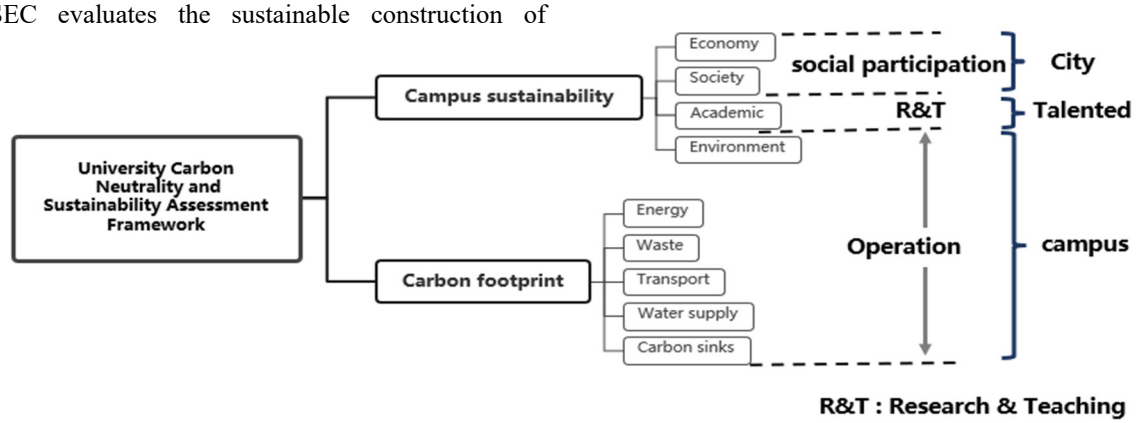

Figure 3. University Carbon Neutrality and Sustainability Assessment Framework

China ' s sustainable campus construction is vigorously promoted by the government, and it is urgent to evaluate the construction effect. Assessmenting sustainability on Chinese university campuses (ASCUC) [9] is a sustainability assessment system proposed by Chen Shuqin and others for Chinese university campuses. ASCUC evaluates university sustainability from five aspects: organization and management, energy and resource conservation, friendly environmental campus culture and social development, and evaluates campus dual-carbon performance through indicators such as energy and waste. ASCUC contains 14 secondary indicators, including 3 at the educational level, 3 at the research level, 2 at the social participation level and 6 at the operational level; from the scope of influence, there are 6 campus level, 5 city level and 3 talent industry level.

The above evaluation system indicators can be roughly divided into three categories -- statistical indicators, such as greenhouse gas emissions; institutional information indicators, such as management policies; news text indicators, such as international communication news. To construct the database of Sustainable universities in China, we need to select and determine data sources, measurement methods and alternative computing schemes, collect a large amount of data, combine various modern technologies and make use of various mathematical algorithms. Statistical indicators can be collected from national public data and processed by statistical accounting method. System information indicators can be collected from the official website of the school and processed by text analysis. News text index can be collected from Baidu and processed by data mining method.

After the text data is collected, the data is preprocessed according to the validity and accuracy principles, including data cleaning, text word segmentation, stopping words, text feature extraction, word frequency statistics, text vectorization and other methods. Then, multi-label classification is carried out. By observing the data of sustainable university evaluation index, we find the characteristics of its imbalance. For the solution of this kind of problem, it can be balanced from the perspective of data, evaluation index and algorithm. Then the bayesian theorem is applied, and the classification results are calculated by naive Bayesian algorithm, and the accuracy, recall and F1-score are used to test the results. Finally come to a conclusion. [13]

Naive bayes classification (NBC) is based on bayes' theorem and characteristics of hypothesis conditions between independent method, pass has been given training set, with key between independence as a premise, learning from the input to the output of the joint probability distribution, then based on the study to the model, the input X to the biggest output Y posterior probability.

Set sample data set D={d1, d2,…,dn}, corresponding sample data feature attribute set X={x1, x2,…,xd}, class variable Y={y1, y2,…,ym}, that is, D can be divided into ym category. Where x1, x2,…,xd is independent and random, then the prior probability Pprior=P(Y) of Y and the posterior probability Ppost=P(Y|X) of Y can be obtained by the naive Bayes algorithm, and the posterior probability can be calculated by prior probability Pprior=P(Y), evidence P(X) and quasi-conditional probability P(X|Y):

$$P(Y|X)=\frac{P(Y)P(X|Y)}{P(X)} \quad (1)$$

Naive Bayes is based on the independence of each feature. In the case of given category Y, the above formula can be further expressed as the following formula:

$$P(X|Y=y)=\prod_{i=1}^{d} P\ (x_i|Y=y) \quad (2)$$

Since the magnitude of P(X) is fixed, when comparing the posterior probability, only the molecular part of the above equation can be compared. Therefore, a naive Bayesian calculation of sample data belonging to category yi can be obtained:

$$P(y_i \mid x_1, x_2,\ldots,x_d)=\frac{P(y_i)\prod_{j=1}^{d} P\ (x_j|y_i)}{\prod_{j=1}^{d} P\ (x_j)} \quad (3)$$

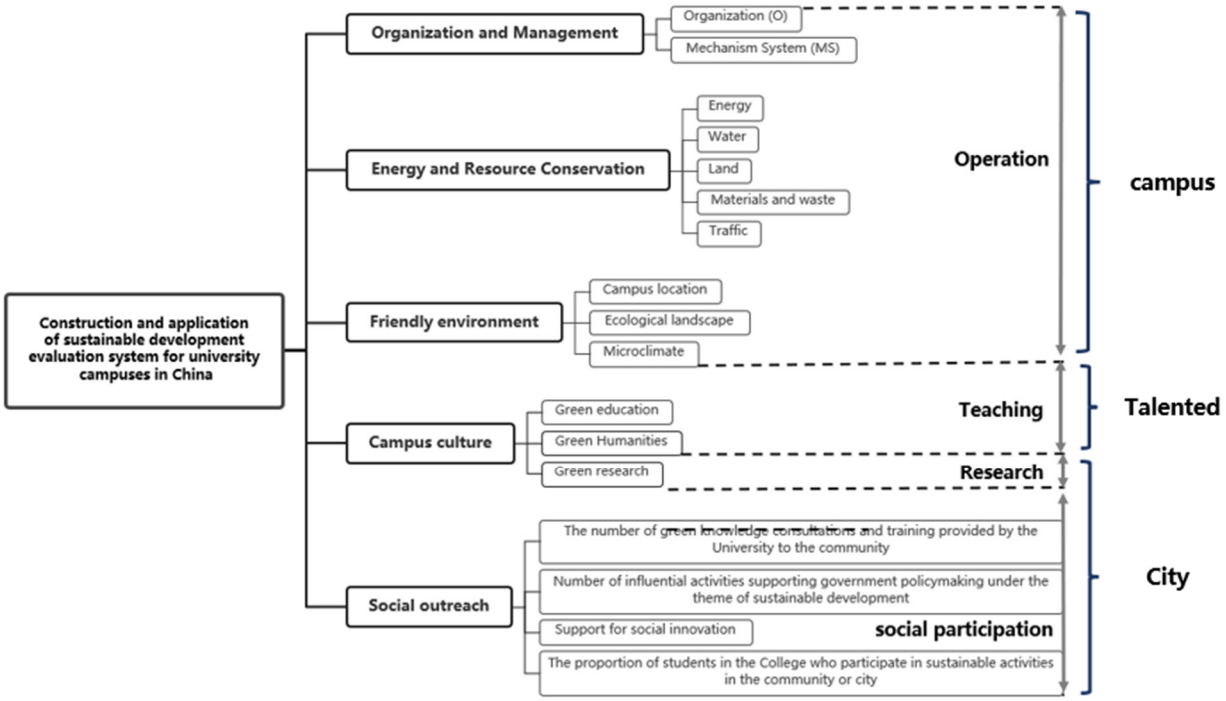

Figure 4. Assessmenting sustainability on Chinese university campuses (ASCUC)

4. CONCLUSIONS

At present, the construction of the index system focuses on the campus city level in the scope of influence, and is still a blank at the international level. There is still a lack of education and scientific research dimensions in the campus function, and focuses on the operation level and social participation level. In constructing the sustainable evaluation system of Chinese universities under the background of dual-carbon, it is necessary to pay attention to supplement international indicators and increase teaching and scientific research indicators.

This paper shows the focus of the current evaluation system construction by combing the indicators of the evaluation system of sustainable universities, which provides a theoretical basis and construction ideas for the construction of the sustainable evaluation system of Chinese universities in the context of double carbon.

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