



# Structural Modeling of Higher Education Based on Sustainable Development Components Using a Mixed Method (Case Study: South Pars Region)

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## Abstract

The aim of this study is to structurally model higher education based on sustainable development components using a mixed-method approach. This applied research employs a mixed-method (qualitative-quantitative) design. The statistical population includes 12 specialists and academic experts in the field of sustainable development in general, and sustainable development in higher education in particular. In the qualitative section, their opinions were used to identify and code the categories. For the modeling process, the statistical population consisted of faculty members, postgraduate students from the Persian Gulf University, and specialists from the South Pars Special Economic Zone, including experts in environmental sciences, economics, social sciences, and faculty members and postgraduate students from Persian Gulf University. The sample size was calculated using Cochran's formula for unknown populations, resulting in a sample size of 384 individuals, with a random accessible sampling method. To identify the factors, interviews were conducted, and through open, selective, and axial coding, categories and concepts were extracted. The results of this phase yielded 451 open codes, 24 axial codes, and 8 selective codes. Subsequently, in the next phase, the Delphi technique was used to filter the central, causal, contextual, intervening, strategic, and outcome conditions through three rounds of screening. Ultimately, consensus was reached on 135 open codes. For the modeling process, structural equation modeling and partial least squares (PLS) software were used. The results of the study revealed that the structural modeling of higher education based on sustainable development components, using the mixed method, includes 2 causal conditions and 8 subcriteria, 1 contextual condition and 3 subcriteria, 1 intervening factor and 2 subcriteria, 2 strategies and 5 subcriteria, and finally, 2 major outcomes with 5 subcriteria. These outcomes, ranked by priority, are the development of sustainable projects and businesses (with a factor loading of 0.633) and the management of natural resources and the environment (with a factor loading of 0.524). Consequently, it can be concluded that focusing on sustainable development in the region enhances business development and the conservation and management of natural resources.

**Keywords:** Higher Education, Sustainable Development, South Pars, Grounded Theory, Modeling

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## 1. Introduction

Sustainable development education in the past was heavily criticized due to its profit-driven perspective, which was primarily focused on students in business schools, based on the conventional business definition aimed at maximizing shareholder wealth [1, 2]. This limited perspective, which gave rise to contemporary issues such as financial crises and unethical management, led to the realization that businesses

should not focus on maximizing short-term profits [3, 4]. Instead, they should emphasize responsible management to achieve long-term sustainability. Today, more than ever, professionals are being hired by businesses to consider the sustainability mindset and skills of their employees [5]. These experts continue to emphasize the need to raise awareness among today's business graduates regarding sustainability practices [6]. This requires sustainable development education, which redefines the meaning of



sustainable development by fostering a sense of sustainability among learners. Sustainable development has become a driving force in development planning across various regions of the world and is now considered a necessity. In the era of sustainable development, higher education plays a vital role and is regarded as one of the most important social institutions for creating the necessary conditions for commitment and for implementing the concept of sustainable development and addressing environmental risks [7].

At the 2012 Rio de Janeiro Sustainable Development Conference, it was emphasized that higher education institutions should consider themselves committed to the following: sustainable policies in teaching and education, research and inquiry to improve learning processes through the exchange of scientific and technical knowledge, promoting development, adaptation, dissemination, and transfer of knowledge, including new and renewable technologies, sustainable infrastructure, reducing ecological footprints in universities, sustainable supply chains, food services, transportation systems, aligning with efficient programs for waste reduction, recycling, and reuse, and finally, promoting sustainable lifestyles, supporting environmental sustainability policies, and active participation in international frameworks. Therefore, universities are the source of structural changes, creating innovative and sustainable functions, and institutionalizing these functions within their structures towards sustainability. At the educational and student level, sustainable higher education enables learning and raising awareness about environmental issues, changing lifestyles towards sustainability, and motivating individuals to act pragmatically to address environmental challenges, empowering students to adopt and institutionalize the concept of sustainability in their lifestyles and the lives of those around them [5].

Scientists and experts have presented various reasons highlighting the necessity of environmental education for students in higher education institutions [8]. The literature on the role of higher education in sustainable development reflects a growing recognition of its importance across various dimensions. Ashida (2023) highlights that the goal of higher education is not only to ensure equal access for all individuals to affordable and high-quality technical, vocational, and higher education but also to guarantee the quality of education as a crucial component in achieving sustainable development goals [9]. Karimi (2021) underscores the necessity of incorporating sustainability into

the curriculum of higher education in handicrafts, emphasizing knowledge skills, such as system thinking and interdisciplinary collaboration, as well as the ability to change attitudes towards dominant artistic, social, and cultural discourses [10]. Arab et al. (2021) investigate the role of spatial planning in health education and its impact on sustainable development and educational justice, finding a stronger relationship between spatial planning and sustainable development than with educational justice [11]. Mahdavi (2020) discusses the inefficiency of Iran's higher education in promoting sustainable development and suggests that long-term policies, as opposed to short-term ones, are essential for enhancing the effectiveness of higher education in driving economic growth [12]. Mohammad et al. (2019) identify key factors influencing sustainable higher education development, such as university management commitment, sustainability-oriented education, and infrastructure support, which explain 52.1% of the variance in sustainable education development [13]. Kolayi et al. (2018) argue that the educational and research dimensions of university growth centers significantly impact sustainable development, with the educational dimension showing the highest influence [14]. Mirsanjari et al. (2018) assess the current state of public universities in Tehran based on key factors affecting sustainable development, finding that areas such as research and human resources are performing well above average [15].

Education, by promoting a culture of equality, inclusive growth, and shared responsibility [16], contributes to the broader vision of sustainability and is therefore recognized as an independent goal within the Sustainable Development Goals [17]. There is consensus among experts that education for sustainable development empowers individuals to make decisions and take actions that advance the sustainable development agenda in various countries [18].

Considering the above points, addressing sustainable development issues within higher education institutions and contributing to the preservation and conservation of the environment are fundamental priorities that universities must incorporate into their core programs. The aim of the present study is to structurally model higher education based on sustainable development components using a mixed-methods approach.

## 2. Methodology

This research, due to its descriptive nature, is of a qualitative-quantitative (mixed) type and is applied in terms

of its objective. The statistical population of the study for the qualitative section, which aimed to identify factors, included 12 experts and academic specialists in the field of sustainable development in general and sustainable development in higher education specifically. For the modeling section, the statistical population consisted of: 1) faculty members and postgraduate students from the Persian Gulf University, and 2) specialists from the South Pars Special Economic Zone, including experts in environmental sciences, economics, social sciences, faculty members, and postgraduate students from the Persian Gulf University. The sample size of 384 individuals was determined, and simple random sampling was employed in this study.

Data were collected using a researcher-developed questionnaire that had been validated by experts. The questionnaire was based on a Likert scale, and its reliability was measured using Cronbach's alpha, which yielded a total value of 0.790, indicating acceptable reliability. The validity of the questionnaire was also confirmed by experts, and both content validity and AVE validity were calculated and confirmed. To analyze the data and test the hypotheses, Structural Equation Modeling (SEM) using the Partial Least Squares (PLS) method and Smart PLS software was employed.

**Table 1.** Demographic Variables of the Research

Variable	Range	Number	Percentage
Gender	Male	329	85.67
	Female	55	14.32
Age	31 to 35 years	39	10.15
	36 to 40 years	118	30.72
	41 to 45 years	137	35.67
	Older than 46 years	90	23.43
Education	Bachelor's degree	156	40.62
	Master's degree	210	54.68
	Doctorate	18	4.68
Total		384	100

The results of convergent validity and Cronbach's alpha coefficient can be seen in [Table 2](#).

**Table 2.** Results of Convergent Validity with AVE Criterion and Reliability Value

Variables	AVE	CR	CR > AVE	(Alpha > 0.7)
Establishment of Research & Development Centers	0.764	0.723	OK	0.764
Research and Innovation	0.723	0.754	OK	0.723
Education and Awareness	0.798	0.740	OK	0.780
Health and Well-being	0.823	0.714	OK	0.712
Collaboration and Interaction	0.702	0.722	OK	0.730
Use of Renewable Energy & Promotion of Green Culture	0.723	0.707	OK	0.845
Natural Resources and Environmental Management	0.765	0.745	OK	0.825
Development of Sustainable Projects and Businesses	0.718	0.861	OK	0.863
Education and Awareness (Second Entry)	0.780	0.931	OK	0.780

First, using the Delphi technique, the identified factors were finalized. According to this technique, each group member was given a questionnaire containing the relevant criteria. The experts, who were selected from a pool of 12 professionals familiar with all the matters, reviewed each index. For the initial screening of the identified indicators, scores between 1 and 9 were assigned, and those with scores below 7 were discarded. The Delphi technique concluded after the third round, when a final consensus was reached.

Given that the average of all the criteria in the table above was higher than 0.7, the dimensions were finalized as the main outcomes. These dimensions were used as the basis for measuring and designing the research questionnaire for modeling purposes.

### 3. Findings and Results

Descriptive statistics were used to analyze the demographic variables. The table below presents the demographic variables of the research based on the data collected and analyzed. The results of the demographic characteristics are shown in [Table 1](#).

As shown in Table 2, since the appropriate value for AVE is 0.5, all variables in Table 3 have an average extracted variance greater than 0.5, confirming the validity of the convergent results using this index. Additionally, the reliability value is above 0.7, indicating the appropriate reliability of the variables under study.

As previously mentioned, to present the structural modeling of higher education based on the components of sustainable development using a mixed-methods approach in the South Pars region, structural equations were employed. Ultimately, the research model is displayed in Figure 1, where all dimensions in the model become significant.

In testing the significance of the relationship (or lack thereof) between independent and dependent variables, if the

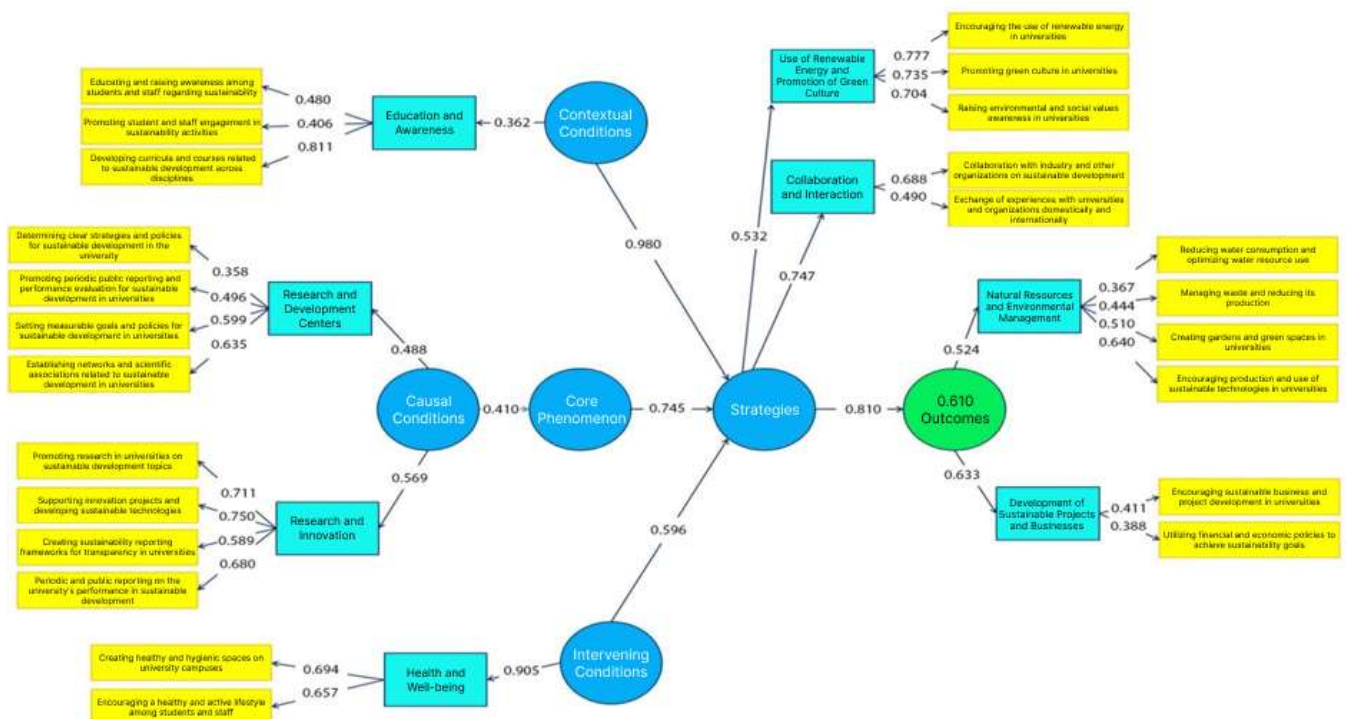
t-statistic between two variables is greater than the absolute value of 1.96 and the significance level is less than 0.05, it means there is a statistically significant relationship between the two variables with a 95% confidence level (Hair, 2006). Additionally, the second condition for establishing convergent validity is that factor loadings should be greater than 0.4.

The final model fit is achieved, and for this purpose, Tenenhaus et al. (2004) introduced the GOF (Goodness of Fit) index. This index is calculated from the geometric mean of the communalities and the coefficient of determination. The closer the value is to one, the stronger and higher the model's quality.

**Table 3.** Overall Model Fit Results with the GOF Criterion

GOF Formula	Mean Communality	Mean R <sup>2</sup>	GOF Calculation
$\sqrt{\text{Communalities} \times R^2} = \sqrt{0.396 \times 0.610} = 0.383$	0.396	0.610	0.383

According to the results in Table 3, the obtained GOF index is 0.504, which is greater than 0.36, indicating a strong and confirmed model fit.



**Figure 1.** Model with Standardized Factor Loadings and Path Coefficients (Evaluation of Measurement Models)

#### 4. Discussion and Conclusion

In this study, to examine the structural modeling of higher education based on the components of sustainable development using a mixed-methods approach in the South Pars region, structural equations and Partial Least Squares (PLS) methods were used. Ultimately, the research model was drawn, showing that causal conditions with a factor loading of 0.410 influence the core phenomenon. Intervening factors with a factor loading of 0.596 and contextual factors with a factor loading of 0.980, along with the core phenomenon with a factor loading of 0.745, had an effect on the strategies. Furthermore, strategies with a factor loading of 0.810 influenced the outcomes.

As previously mentioned, this study's quantitative model was fitted using structural equations and quantitative methods. Various approaches, such as the assessment of validity and reliability, were used to evaluate the items and factors in the model. Based on the obtained findings, it can be concluded that the research model exhibits a relatively satisfactory internal consistency. To examine and establish the validity and reliability of the tool, comprehensive criteria and methods were employed. Three types of validity indices, including internal consistency, item validity, and discriminant validity, were calculated in two stages of the study. In the findings section, and after assessing the three indices for model validity, it was concluded that the model's validity was adequate and suitable in all three cases. The Cronbach's alpha coefficients increased, and the composite reliability was found to be acceptable. Furthermore, using model fit tests such as  $R^2$  (which equals 0.610) and the calculation of the GOF index, which was found to be 0.383, it was confirmed that the fitted model had strong and adequate fit, and the research findings can be trusted and referenced. Thus, the validity of the research model was confirmed.

As previously stated, this study used a grounded theory approach to examine the dimensions, criteria, and sub-criteria forming the structural modeling of higher education for achieving the components of sustainable development in the South Pars region. The results were obtained in five sections as follows:

The coding results of the interviews indicated that the causal conditions, in order of the factor loading coefficient, are: 1) Research and Innovation (promotion of green and sustainable technologies in universities, promoting innovative research and projects related to sustainable

development, periodic and public reporting of university performance in sustainable development, conducting regular and transparent assessments to measure progress in sustainable development); and 2) Establishment of Research and Development Centers (creating networks and academic associations related to sustainable development in universities, setting measurable goals for sustainable development in universities, implementing environmental sustainability policies in university management, and formulating specific strategies and policies for sustainability development in universities). These results align to some extent with findings from researchers like Mohammadi et al. (2019), who also identified certain criteria and sub-criteria in this area, such as management support and infrastructure, as key factors in sustainable development [13].

The coding results of the interviews revealed that the criterion "Education and Awareness" and its sub-criteria, which respectively had factor loadings (creating curricula and courses related to sustainable development in various disciplines, educating and raising awareness among students and staff about the concepts and goals of sustainable development, and promoting research and studies related to sustainable development in universities), were identified as contextual factors influencing the structural modeling of higher education based on sustainable development components using the mixed-methods approach in the South Pars region.

The coding results of the interviews indicated that the identified criteria for intervening conditions, in order of factor loading, were: Health and Well-being (creating healthy and hygienic spaces in universities and encouraging a healthy and active lifestyle among students and staff), which serve as intervening factors that influence the structural modeling of higher education based on the components of sustainable development using a mixed-methods approach in the South Pars region. These results align to some extent with findings from researchers such as Kolaei Darabi and Taghvaei Yazdi (2018), who also mentioned certain criteria and sub-criteria in this section, such as the creation of healthy and hygienic spaces as intervening factors in sustainable development [14].

The coding results of the interviews revealed that, in order of factor loading, the strategies identified were: 1) Collaboration and Interaction (collaboration with industry and other organizations in the field of sustainable development, exchange of experiences with other universities and related organizations both inside and outside the country); and 2) Use of Renewable Energy and

Promotion of Green Culture (encouraging the use of renewable energy in universities, promoting green culture within universities, motivating students to continue sustainable behaviors, and promoting environmental and social values in universities). These strategies are considered effective for structural modeling of higher education based on the components of sustainable development using a mixed-methods approach in the South Pars region.

The coding results of the interviews indicated that, in order of factor loading, the outcomes identified were: 1) Development of Sustainable Projects and Businesses (encouraging the development of sustainable projects and businesses in universities, using financial and economic policies to achieve sustainable development in universities); and 2) Management of Natural Resources and Environment (encouraging the production and use of technological resources in universities, creating gardens and green spaces on university campuses, waste management, and reducing waste production, reducing water consumption, and optimizing the use of water resources). These outcomes are considered consequences of sustainable development in the South Pars region. These results partially align with the findings of researchers such as Mahdavi (2020), who also highlighted certain criteria and sub-criteria in this section as outcomes of sustainable development.

Based on the results obtained, the following recommendations are offered to the managers of the South Pars region for promoting sustainability goals:

- Conduct extensive advertising campaigns on research and innovative projects related to sustainable development in the industry.
- Regularly perform transparent and systematic evaluations to measure progress in sustainable development.
- Facilitate collaboration between industry and other organizations in the field of sustainable development.
- Organize training and orientation classes regarding waste management and reducing waste production.

#### Authors' Contributions

Authors equally contributed to this article.

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#### Declaration of Interest

The authors report no conflict of interest.

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#### Ethical Considerations

All procedures performed in this study were under the ethical standards.

#### References

- [1] A. Ghorbani Sheikh Nashin and S. Haddad Zand, "A Comparative Study of Clean Energy Policy in Sustainable Development of China and the USA," *Iranian Journal of International Politics*, vol. 12, no. 2, pp. 437-464, 2024.
- [2] M. García-Feijoo, A. Eizaguirre, and A. Rica-Aspiunza, "Systematic review of sustainable-development-goal deployment in business schools," *Sustainability*, vol. 12, no. 1, p. 440, 2020, doi: 10.3390/su12010440.
- [3] H. Mazal Alak, Y. Mohammadzadeh, and S. Hekmati Farid, "Investigating the Impact of Logistics Performance on Sustainable Development in Emerging Countries: A Spatial Approach," *Applied Economic Theories Quarterly*, vol. 11, no. 1, pp. 97-134, 2024.
- [4] T. Suaco, "The Integration of Sustainable Development Goals in the Secondary Science Curriculum of Cordillera Administrative Region," *Diversitas Journal*, vol. 9, no. 1\_Special, 2024, doi: 10.48017/dj.v9ispecial1.2835.
- [5] M. Chiang and P. Chen, "Education for sustainable development in the business programme to develop international Chinese college students' sustainability in Thailand," *Journal of Cleaner Production*, vol. 374, p. 134045, 2022, doi: 10.1016/j.jclepro.2022.134045.
- [6] S. Chen, M. Lu, H. Tan, X. Luo, and J. Ge, "Assessing sustainability on Chinese university campuses: Development of a campus sustainability evaluation system and its application with a case study," *Journal of Building Engineering*, vol. 24, p. 100747, 2019, doi: 10.1016/j.jobe.2019.100747.
- [7] W. Leal Filho, A. L. Salvia, and J. H. P. P. Eustachio, "An overview of the engagement of higher education institutions in the implementation of the UN sustainable development goals," *Journal of Cleaner Production*, vol. 135694, 2022, doi: 10.1016/j.jclepro.2022.135694.
- [8] J. M. Lopes, N. Suchek, and S. Gomes, "The antecedents of sustainability-oriented entrepreneurial intentions: An exploratory study of Angolan higher education students," *Journal of Cleaner Production*, vol. 136236, 2023, doi: 10.1016/j.jclepro.2023.136236.
- [9] A. Ashida, *The Role of Higher Education in Achieving the Sustainable Development Goals Sustainable Development Disciplines for Humanity*. Springer, Singapore, 2023.
- [10] S. Karimi, "Reconsidering Educational Skills for Sustainable Development in the Content and Methods of Higher Education in Handicrafts," *Journal of Craft Arts Pathways*, vol. 1, no. 2, pp. 1-15, 2021.
- [11] F. Arab, F. Zamani, and T. Enayati, "The Impact of Land Use Planning with a Focus on Health Higher Education on

- Sustainable Development and Educational Justice in Medical Science Universities of the First Meta-Region," *Iranian Journal of Medical Education*, vol. 21, no. 84, pp. 1-12, 2021.
- [12] A. Mahdavi, "Investigating the Efficiency of Higher Education in Iran in Achieving Sustainable Development," *Journal of Economic Research (Growth and Sustainable Development)*, vol. 20, no. 4, pp. 1-32, 2020.
- [13] Y. Mohammadi, F. Manavifard, Salehi, and R. Mohammadi, "Factors Influencing the Development of Sustainable Higher Education from the Perspective of Students at the Agriculture Faculty of Bu-Ali Sina University," *Agricultural Education Management Research*, vol. 48, pp. 57-74, 2019.
- [14] R. Kolaei Darabi and M. Taghvaei Yazdi, "Presenting a Model of Educational and Research Dimensions of Growth Centers and Its Impact on the Sustainable Development of Universities," *Educational Planning Studies*, vol. 7, no. 14, pp. 146-171, 2018.
- [15] A. Mirsanjari, "Current Status of Public Universities in Tehran Based on Factors Influencing Sustainable University Development," *Higher Education Quarterly*, vol. 3, no. 2, pp. 139-165, 2018.
- [16] A. K. Holfelder, "Towards a sustainable future with education?," *Sustainability Science*, vol. 14, no. 4, pp. 943-952, 2019, doi: 10.1007/s11625-019-00682-z.
- [17] UNESCO, *Education for Sustainable Development: A Roadmap*. 2020.
- [18] P. Priyadarshini and P. C. Abhilash, "Rethinking of higher education institutions as complex adaptive systems for enabling sustainability governance," *Journal of Cleaner Production*, vol. 359, p. 132083, 2022, doi: 10.1016/j.jclepro.2022.132083.