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Measuring Cultural Sustainability: A Comparative Analysis of South Korea, China, and Japan Using the Cultural Sustainability Measurement Index (CSMI)

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Abstract

Cultural sustainability, recognized as the fourth pillar of sustainable development, has gained increasing prominence in recent years. This study proposes a comprehensive Cultural Sustainability Measurement Index (CSMI) that integrates four key dimensions: cultural, economic, governance, and environmental. To check the validity of the CSMI, the study employs correlation analysis to establish the interconnectedness of the four dimensions. Subsequently, the data is normalized, and the sub-indices are weighted equally to derive the aggregate CSMI index. This comprehensive approach acknowledges the complex interplay between cultural, economic, governance, and environmental factors, and their collective influence on the overall sustainability of societies. This study introduces two key contributions: (1) the development of a new framework for measuring cultural sustainability, and (2) the first empirical comparison of cultural sustainability across the East Asian countries of South Korea, China, and Japan. The study applies the CSMI to South Korea, China, and Japan, providing a comparative analysis of cultural sustainability performance across these East Asian countries. Through graphical representations, the research highlights the relative strengths and weaknesses of each nation, facilitating benchmarking and the identification of best practices. This visual analysis enables policymakers, cultural organizations, and stakeholders to assess the current state of cultural sustainability, identify areas for improvement, and develop targeted strategies to promote the preservation and continuation of cultural heritage, diversity, and expressions. By integrating the four dimensions and offering a quantitative measure of cultural sustainability, this study provides further insights into the growing body of literature on this topic. It provides valuable insights and recommendations for policymakers, cultural organizations, and stakeholders to develop holistic and integrated approaches that foster sustainable economic growth, effective governance, and environmental stewardship while preserving and nurturing cultural heritage and expressions.

Key words: CSMI; sustainability; correlation; cultural heritage; Korea, China, and Japan

1. Introduction

Cultural sustainability is a concept that has gained significant attention in recent years, particularly in the context of South Korea's rapid economic growth and urbanization. The theory posits that cultural heritage, diversity, and practices are essential for a country's sustainable

development, alongside environmental and economic factors (Bandarin et al., 2011). This introduction will provide an in-depth explanation of the cultural sustainability theory, its importance for understanding the cultural performance of South Korea, and its limitations. The concept of sustainability circles and its relevance to our research will be discussed, drawing on James's work (2014) as a guiding framework.

Cultural sustainability is an emerging concept within the broader framework of sustainable development, which traditionally encompasses three pillars: economic, social, and environmental sustainability. However, there has been a growing recognition of culture as a fourth pillar, essential for achieving holistic and enduring sustainability. Cultural sustainability refers to the preservation and continuation of cultural heritage, practices, and values, ensuring their transmission to future generations. It encompasses various aspects such as traditional knowledge, cultural identity, aesthetic and artistic expressions, and the ways in which cultures perceive and interact with the world (Loach & Rowley, 2022; Järvelä, 2023).

The theoretical foundation of cultural sustainability is rooted in the understanding that culture is both an enabler and a driver of sustainable development. Culture influences people's beliefs, decisions, and behaviors, thereby shaping societal norms and practices. This influence extends to economic activities, social interactions, and environmental stewardship. For instance, cultural values can drive sustainable consumption patterns, promote social cohesion, and foster respect for natural resources (Soini & Dessein, 2016; Soini & Birkeland, 2014).

One of the key dimensions of cultural sustainability is the preservation of cultural heritage, which includes tangible elements like historical sites, artifacts, and monuments, as well as intangible elements such as languages, rituals, and traditional crafts. The preservation of these cultural assets is crucial for maintaining the identity and continuity of communities. UNESCO's *"Convention for the Safeguarding of the Intangible Cultural Heritage"* underscores the importance of protecting cultural heritage against various threats, recognizing that culture guarantees sustainability by fostering a sense of belonging and continuity (Aikawa, 2004).

Cultural sustainability also involves adaptive capacity and social resilience (Crane, 2010). In the face of contemporary challenges such as climate change, pandemics, and geopolitical conflicts, cultural sustainability emphasizes the need for communities to adapt while preserving their cultural essence. This adaptive capacity is linked to social resilience, which refers to the ability of communities to withstand and recover from disruptions while maintaining their cultural integrity (Sawalha et al., 2015). By fostering social resilience, cultural sustainability contributes to the overall stability and well-being of societies.

Moreover, cultural sustainability is intertwined with political stability and governance. Effective governance frameworks that respect and promote cultural diversity are essential for creating an environment where cultural practices can thrive. Political stability ensures that policies and initiatives aimed at cultural preservation and promotion are implemented effectively. This includes recognizing and protecting cultural rights, supporting cultural industries, and fostering intercultural dialogue (Galvan, 2004; Sofield & Li, 2013).

Overall, cultural sustainability is a multifaceted concept that plays a critical role in sustainable development. It involves the preservation of cultural heritage, the promotion of cultural diversity, and the enhancement of social resilience and adaptive capacity. By integrating cultural considerations into economic, social, and environmental policies, societies can achieve more inclusive and sustainable outcomes. The recognition of culture as a fourth pillar of sustainability highlights its indispensable role in shaping sustainable development trajectories.

In recent years, there has been a growing recognition of the pivotal role that culture plays in achieving sustainable development. While the traditional pillars of sustainability – economic, social, and environmental – have been widely acknowledged, the cultural dimension has often been overlooked or given less emphasis. However, culture is deeply intertwined with all aspects of human life, shaping our values, beliefs, and behaviors, and influencing our interactions with the natural environment and economic systems.

Scholars and practitioners have advocated for the inclusion of culture as the fourth pillar of sustainability, alongside the economic, social, and environmental dimensions (Nurse, 2006; Sabatini, 2019; Gartler et al., 2020). One notable proponent of this approach is Paul James, whose work on "*Urban Sustainability in Theory and Practice: Circles of Sustainability*" provides a comprehensive framework for understanding and addressing the complexities of urban sustainability.

Building on James's suggestion, the development of a Cultural Sustainability Measurement Index (CSMI) is proposed, incorporating these four pillars of sustainability. By integrating economic, governance, cultural, and environmental sub-indices, the CSMI provides a more holistic and multidimensional approach to assessing and promoting cultural sustainability in urban areas.

The importance of developing such an index cannot be overstated, as it serves several crucial purposes:

1)Recognizing the intrinsic value of culture: Culture is not merely a byproduct of human societies but a fundamental aspect of our existence. It shapes our identities, traditions, and ways of life, and contributes to the richness and diversity of human experience. By developing a dedicated index for cultural sustainability, we acknowledge the intrinsic value of culture and its role in shaping sustainable development pathways.

2)Promoting cultural diversity and heritage preservation: The CSMI provides a framework for assessing and monitoring the state of cultural heritage, practices, and expressions within urban areas. It enables the identification of threats to cultural diversity and the development of strategies for preserving and safeguarding tangible and intangible cultural assets, ensuring their transmission to future generations.

3)Enhancing social cohesion and resilience: Culture plays a vital role in promoting social cohesion, fostering a sense of belonging, and enhancing community resilience. By incorporating cultural indicators, the CSMI recognizes the importance of cultural factors in building inclusive, harmonious, and resilient societies capable of withstanding and adapting to various challenges.

4)Integrating cultural considerations into urban planning and development: The CSMI serves as a valuable tool for urban planners, policymakers, and cultural organizations, enabling them to integrate cultural considerations into urban planning and development processes. This ensures that cultural heritage, practices, and expressions are respected, preserved, and promoted within the built environment, contributing to the overall sustainability and livability of urban areas.

5)Aligning with global sustainability goals: The development of the CSMI aligns with international efforts and frameworks aimed at promoting sustainable development, such as the United Nations' Sustainable Development Goals (SDGs) and the UNESCO conventions on cultural heritage. By incorporating cultural indicators, the CSMI contributes to the achievement of these global goals and fosters international cooperation and knowledge-sharing in the realm of cultural sustainability.

By building on James's suggestion and developing a comprehensive Cultural Sustainability Measurement Index, we aim to highlight the importance of culture in shaping sustainable development trajectories. The CSMI offers a framework for assessing, monitoring, and promoting cultural sustainability, ensuring that the cultural dimension is considered alongside economic, social, and environmental factors in the pursuit of more holistic and enduring sustainability.

South Korea has a rich and vibrant cultural tapestry, encompassing traditions, arts, and practices that have been shaped over centuries. However, rapid urbanization, globalization, and economic transformations pose challenges to the preservation and continuation of these cultural assets. By developing a CSMI, South Korea can effectively assess, monitor, and promote cultural sustainability, ensuring that its unique cultural identity and expressions are safeguarded for future generations.

This paper makes significant contributions by proposing a comprehensive Cultural Sustainability Measurement Index (CSMI) that incorporates the four pillars of sustainability: economic, governance, cultural, and environmental. Drawing from Paul James's work on "*Urban Sustainability in Theory and Practice: Circles of Sustainability,*" the CSMI recognizes culture's intrinsic value and profound influence on various aspects of human life.

One key contribution is the development of the CSMI for South Korea, a country rich in cultural heritage facing challenges in preservation amidst rapid urbanization and globalization. The CSMI's four sub-indices (economic, governance, cultural, and environmental) provide a holistic approach to assessing and promoting cultural sustainability in South Korea. Furthermore, the paper extends the CSMI's application to Japan and China, enabling cross-cultural analysis and knowledge-sharing within the East Asian region.

By comparing the CSMI across South Korea, Japan, and China, this paper aims to have a deeper understanding of cultural sustainability challenges and opportunities within the East Asian region. It facilitates benchmarking, identification of best practices, and the development of targeted strategies for promoting cultural sustainability. This study examines three research questions: (1) How can cultural sustainability be quantified? (2) In what ways do Korea, Japan, and China differ in their cultural sustainability performance? (3) What are the policy and governance implications of these differences?

2. Literature review

The concept of sustainable development has traditionally been grounded in three pillars: economic growth, social inclusion, and environmental protection. However, there has been a growing recognition of culture as a crucial fourth pillar, essential for achieving holistic and enduring sustainability. This literature review explores the rationale and significance of integrating culture into the sustainable development framework.

Culture plays a fundamental role in shaping human values, beliefs, and behaviors, which in turn influence economic activities, social interactions, and environmental stewardship. As highlighted by the *European Journal of Sustainable Development* (2019), cultural policies and practices have the ability to generate sustainable growth across various domains, including the creative and artistic sectors. *The Policy Statement by the Executive Bureau of UCLG* (2010) advocates for the integration of a cultural dimension in public policies, emphasizing the interconnectivity of culture with economic, social, and environmental sustainability.

The recognition of culture as the fourth pillar of sustainability acknowledges its intrinsic value and its profound influence on all aspects of human life. Culture is not merely a byproduct of societies but a fundamental aspect of our existence, shaping identities, traditions, and ways of life. As Astara (2015) emphasizes, culture contributes significantly to sustainable development through heritage management and investments in cultural activities, which not only address environmental challenges but also foster economic growth and social cohesion.

Incorporating cultural considerations into sustainable development policies and practices is essential for preserving cultural heritage, promoting diversity, and ensuring the well-being of communities. The UNESCO report "*Culture: at the heart of Sustainable Development Goals"* (2023) highlights the crucial role of culture in achieving various Sustainable Development Goals (SDGs), such as making cities inclusive, safe, and resilient (SDG 11), promoting decent work and economic growth (SDG 8), and revitalizing global partnerships (SDG 17).

Cultural heritage, both tangible and intangible, and creativity are valuable resources that need to be protected and carefully managed. They can serve as drivers for achieving the SDGs and as enablers, ensuring the success of interventions through culture-forward solutions. For instance, the adaptive reuse of abandoned buildings in Nablus, Palestine, has benefited local communities by transforming the ancient caravanserai of Khan Al Wakala into a mixed-use public space for cultural activities, fostering social cohesion and strengthening the local economy.

The importance of cultural sustainability extends beyond the preservation of heritage and the promotion of diversity. It also encompasses the integration of traditional knowledge systems and environmental management practices, which can provide valuable insights and tools for tackling biodiversity loss, land degradation, and climate change mitigation. Cultural factors influence lifestyles, consumption patterns, and our interaction with the natural environment, making culture a critical consideration in achieving environmental sustainability.

Cultural sustainability is increasingly recognized as a critical component of sustainable development, alongside economic, social, and environmental dimensions. It involves the preservation and continuation of cultural heritage, practices, and values, ensuring their

transmission to future generations. Measuring cultural sustainability is essential for understanding its impact and integrating cultural considerations into broader sustainability frameworks.

One common approach to measuring cultural sustainability is the development of cultural indicators and indices. These tools assess various aspects of cultural heritage, diversity, and participation. For instance, the *UNESCO Culture for Development Indicators* (CDIS) framework includes indicators related to cultural participation, education, governance, and the economy. This framework provides a holistic view of cultural sustainability by integrating cultural indicators into broader development metrics (Duxbury, 2005).

Another approach involves sustainability culture assessments, which evaluate perceptions, beliefs, dispositions, and behaviors related to sustainability within a community or institution (Dake, 1991). The AASHE STARS program, for example, includes a credit for assessing sustainability culture, covering multiple sustainability topics and evaluating awareness of campus sustainability initiatives. These assessments help institutions understand the cultural dimensions of sustainability and identify areas for improvement.

Preserving cultural heritage is a key aspect of cultural sustainability. This involves safeguarding tangible and intangible cultural assets, such as historical sites, artifacts, languages, and traditional practices. *The UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage* emphasizes the importance of protecting cultural heritage against various threats and ensuring its transmission to future generations. Measures of cultural heritage preservation often include the number of protected sites, the extent of community involvement in preservation efforts, and the availability of funding for cultural initiatives.

Community-centered approaches to cultural sustainability focus on engaging local communities in the preservation and promotion of their cultural heritage (O'Brien & Ponting, 2013). These approaches recognize that cultural sustainability is deeply rooted in the collective identity and values of communities. For example, the Alliance for Sustainable Communities highlights the importance of supporting communities in maintaining their cultural identity during times of crisis or change. Measures in this context may include community participation rates, the effectiveness of cultural education programs, and the resilience of cultural practices in the face of external pressures.

Several key indicators are commonly used to measure cultural sustainability, including cultural participation (engagement in cultural activities) (Poprawski, 2016), cultural education (inclusion of cultural education in curricula) (Solikhah & Budiharso, 2020), cultural governance (policies and legislation supporting cultural preservation) (Bell & Paterson, 2009), economic impact (contribution of cultural industries to the economy) (Van der Pol, 2007), and heritage preservation (number of protected cultural sites and community involvement in preservation efforts) (Blake, 2008).

By using these measures, policymakers, cultural organizations, and communities can develop targeted strategies to preserve and promote cultural heritage, ensuring its transmission to future generations and contributing to overall sustainable development. Measuring cultural sustainability

is essential for understanding its impact and integrating cultural considerations into sustainable development frameworks.

3. Data and methodology

3.1 Data Collection

In this study, a comprehensive approach is used to measure cultural sustainability, based on the four pillars of sustainability outlined by Paul James in *Urban Sustainability in Theory and Practice: Circles of Sustainability*. To operationalize these pillars, proxy measures are employed to represent each dimension."

For the cultural pillar, government expenditure on culture is used as a proxy for cultural development. This measure reflects the financial resources allocated by governments to support and promote cultural activities, heritage preservation, and artistic expressions. By analyzing government expenditure on culture, we can measure the level of commitment and investment in nurturing and sustaining cultural heritage and diversity.

To represent the economic pillar, GDP in billion US dollars is used as a proxy for economic development. This widely recognized indicator reflects the overall economic performance and growth of a country or region. A stable and sustainable economy is important for supporting cultural initiatives, promoting cultural industries, and providing resources for cultural preservation and development.

The governance pillar is proxied by the government effectiveness index, which assesses the quality of public services, the credibility of policy formulation and implementation, and the overall effectiveness of governance structures. Effective governance is crucial for creating an enabling environment that supports cultural sustainability through policies, legislation, and decision-making processes that involve cultural stakeholders and communities.

Finally, to represent the environmental pillar, CO2 emissions in million tons are used as a proxy for environmental sustainability. This measure reflects the impact of human activities on the natural environment and serves as an indicator of a country’s or region’s efforts to mitigate climate change and promote sustainable practices.Environmental sustainability is closely associated with cultural sustainability, as cultural practices and expressions are often influenced by ecological factors and the natural environment.

This analysis covers a comprehensive time period from 1996 to 2023, allowing for a longitudinal examination of cultural sustainability trends and their interplay with economic, governance, and environmental factors. The data sources for these proxy measures are presented in Table 1, ensuring transparency and replicability of the research.

<Table 1> Data description and sources

Data	Proxy for	Source
Annual GDP	Economy	https://data.worldbank.org/indicator
Co2 emissions	Environment	https://ourworldindata.org/co2/country/south-korea#what-are-the-country-s-annual-co2-emissions
Annual budget for the Ministry of Culture, Sports and Tourism	Culture	Press Releases of the Ministry of Finance and Economy
Government effectiveness	Governance	https://databank.worldbank.org/source/worldwide-governance-indicators#

3.2 Methodology

To establish the interconnectedness of the four pillars of sustainability, as suggested by Paul James, a correlation analysis is used to examine the relationships between the proxy variables representing each pillar. The correlation coefficient provides a quantitative measure of the strength and direction of the linear association between two variables.

The equation for calculating the correlation coefficient (r) between two variables X and Y is given by:

$$r=\frac{\sum(X_i-\bar{X})(Y_i-\bar{Y})}{\sqrt{\sum(X_i-\bar{X})^2\times(Y_i-\bar{Y})^2}} \quad (1)$$

where Σ represents the summation notation; X and Y are the respective data points for the two variables; $\bar{X}$ and $\bar{Y}$ are the mean values of X and Y, respectively.

The correlation coefficient (r) ranges from -1 to 1, with values closer to -1 indicating a strong negative correlation, values closer to 1 indicating a strong positive correlation, and a value of 0 indicating no linear correlation between the variables.

The correlation coefficients between the four proxy variables – government spending on culture, GDP value, government effectiveness index, and CO2 emissions – are calculated to assess the strength and direction of the relationships among the cultural, economic, governance, and environmental pillars of sustainability.

After establishing the correlations between the proxy variables representing the four pillars of sustainability, this study proceeds to normalize the data and construct the Cultural Sustainability Measurement Index (CSMI). This step is crucial to ensure that the variables are on a comparable scale and to derive a comprehensive index that integrates the sub-indices for each pillar.

To normalize the data, the following equation is employed:

$$normalized\ value=\frac{value_t-min}{max-min}\times 100 \quad (2)$$

This equation transforms the raw data into a dimensionless scale ranging from 0 to 1, allowing for a fair comparison across different units of measurement.

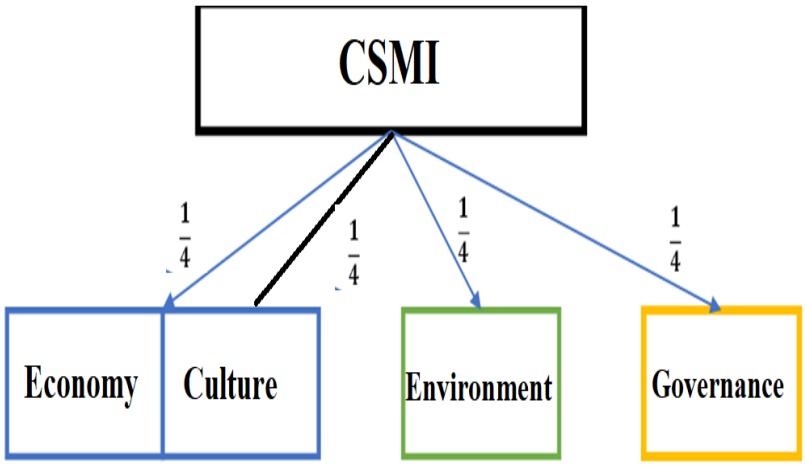
Specifically, for the environmental pillar, focus on CO2 emissions is used as a proxy for environmental sustainability. With equation 2, these emissions are converted into a normalized range between 0 and 100. Subsequently, this value is subtracted from 100 to represent emission control performance, with higher scores indicating better control. This transformation is necessary because the relationship between the CO2 emission index and the performance of CO2 emissions reductions can be expressed as (100 - eq(2)).

After normalizing the data for each pillar, the aggregate CSMI index is derived by summing the sub-indices for culture (government spending on culture), economy (GDP value), governance (government effectiveness index), and environment (CO2 emissions control performance). To ensure equal weighting of the four pillars, as outlined in James's framework, equal weights of 1/4 are applied to each sub-index.

The equal weighting of the four sub-indices is theoretically supported by Paul James's framework, which emphasizes the holistic and interconnected nature of the four pillars of sustainability. According to this framework, each pillar is considered to contribute equally to fostering cultural sustainability, as all dimensions—cultural, economic, governance, and environmental—are essential for long-term sustainability. However, it is acknowledged that alternative theoretical perspectives may prioritize one pillar over others, depending on specific regional contexts or policy objectives.

To assess the robustness of our results, a sensitivity analysis is conducted to examine the stability of the equal weighting assumption. This analysis evaluates the effect of varying the weights across the four pillars on the overall CSMI index. In doing so, it allows for an assessment of whether the equal weighting assumption holds under different scenarios, or if certain pillars exert a disproportionately large influence on the overall index.

The construction of the CSMI index can be represented visually in Figure 1, where the arrows indicate the equal weighting of 1/4 assigned to each sub-index. This visual representation highlights the holistic and balanced approach to measuring cultural sustainability, acknowledging the interconnectedness of the four pillars.



<Figure 1> The aggregation structure of the Cultural Sustainability Measurement Index (CSMI)

The CSMI index is derived to provide a comprehensive and quantitative measure of cultural sustainability, considering the interplay between cultural, economic, governance, and environmental factors. This index can serve as a tool for policymakers, cultural organizations, and stakeholders to assess the current state of cultural sustainability, identify areas for improvement, and inform the development of strategies aimed at promoting the preservation and continuation of cultural heritage, diversity, and expressions.

As a final step, a graphical comparison of the Cultural Sustainability Measurement Index (CSMI) and its sub-indices for South Korea, China, and Japan is presented. This visual representation facilitates the analysis of cultural sustainability performance across these three East Asian countries, highlighting differences in strengths, weaknesses, and areas for further development.

4. Results and discussion

This study first starts the analysis with descriptive statistics of the data. Table 2 presents summary statistics for four sustainability pillars: governance (GOV), economy (GDP), environment (ENV), and culture (CUL). The mean scores show that, on average, governance is 1.191, GDP is 1.103, environment is 537.568, and culture is 3.619. Median values indicate some skewness in the data, particularly for culture, with a median of 2.95, suggesting a positive skew. The range of scores reveals significant variability, with governance scores from 0.359 to 1.942, GDP from 0.383 to 1.974, environment from 355.69 to 670.17, and culture from 0.581 to 9.8, highlighting potential outliers, especially in the cultural data. Standard deviations further illustrate data dispersion: governance at 0.540, GDP at 0.479, environment at 95.465, and culture at 2.702, with higher variability noted in environmental and cultural scores. Skewness values suggest that governance (-0.120) and environment (-0.314) are left-skewed, while GDP (0.095) and culture (0.818) are right-skewed. Positive kurtosis values for all variables indicate leptokurtic distributions, implying more data concentration around the mean and heavier tails than a normal distribution.

<Table 2> Descriptive statistics of data

	GOV	GDP	ENV	CUL
Mean	1.19	1.10	537.56	3.61
Median	1.28	1.09	535.23	2.95
Maximum	1.94	1.97	670.17	9.8
Minimum	0.35	0.38	355.69	0.58
Std. Dev.	0.54	0.47	95.46	2.70
Skewness	-0.12	0.095	-0.31	0.81
Kurtosis	1.55	1.67	1.74	2.66

Table 3 presents the correlation coefficients between four variables representing the four pillars of sustainability. These correlation coefficients measure the strength and direction of the

linear relationship between each pair of variables. The correlation coefficients range from -1 to 1, where a value of 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no linear correlation. In this case, all the correlation coefficients are positive and relatively high, suggesting strong positive relationships between the four pillars of sustainability.

<Table 3> Correlation between four variables

	GOV	ENV	GDP	CUL
GOV	**1**			
ENV	0.95	**1**		
GDP	0.97	0.92	**1**	
CUL	0.93	0.79	0.94	**1**

Firstly, the correlation between governance (GOV) and the other three pillars is particularly strong, with coefficients of 0.95 (ENV), 0.97 (GDP), and 0.93 (CUL). This indicates that effective governance practices are closely associated with better environmental sustainability, economic performance, and the promotion of cultural aspects. Strong governance frameworks, including robust policies, institutional structures, and decision-making processes, create an enabling environment for sustainable development across all dimensions.

Secondly, the correlation between the environment (ENV) and the economy (GDP) is 0.92, suggesting a strong positive relationship between environmental sustainability and economic performance. This aligns with the notion that sustainable economic growth and environmental protection can be mutually reinforcing. Economies that prioritize environmental considerations, such as reducing emissions, promoting renewable energy, and preserving natural resources, can foster long-term economic prosperity and competitiveness.

Furthermore, the correlation between the environment (ENV) and culture (CUL) is 0.79, indicating a moderately strong positive relationship. This relationship highlights the intrinsic link between cultural practices, traditional knowledge, and environmental sustainability. Many cultural traditions and practices have evolved in harmony with the natural environment, promoting sustainable resource management and conservation efforts. Preserving cultural heritage and diversity can contribute to environmental sustainability and vice versa.

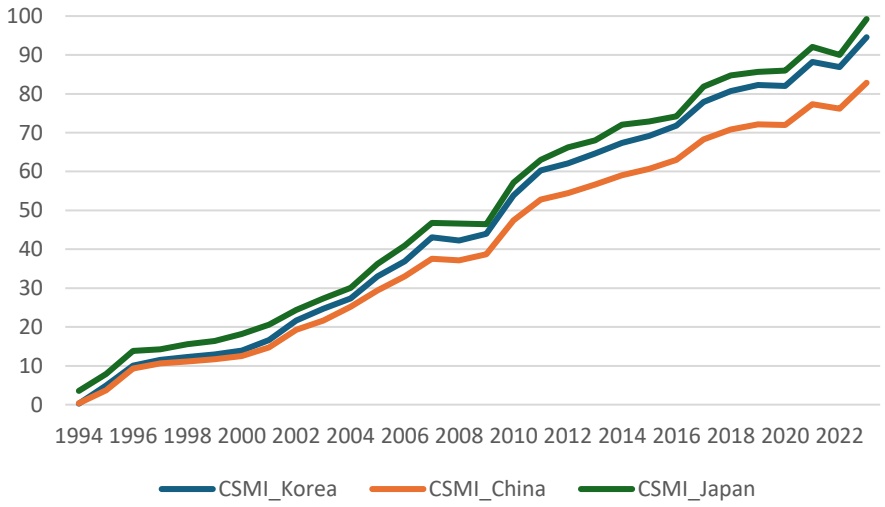
Lastly, the correlation between the economy (GDP) and culture (CUL) is 0.94, suggesting a strong positive association between economic performance and the promotion of cultural aspects. Thriving economies can allocate resources to support cultural industries, preserve cultural heritage, and promote cultural diversity. Conversely, a vibrant cultural sector can contribute to economic growth through tourism, creative industries, and the preservation of traditional knowledge and practices that may have economic value.

To assess the statistical significance of these correlations, significance tests are conducted by calculating p-values associated with the correlation coefficients. The p-values indicate the

probability of obtaining a correlation as extreme as the observed one, assuming no true relationship between the variables. A lower p-value (typically below 0.05) indicates that the correlation is statistically significant. In this case, all the correlation coefficients are highly significant, with p-values less than 0.01, suggesting strong evidence for the positive relationships among the pillars of sustainability.

Overall, these positive correlation coefficients suggest that the four pillars of sustainability are interconnected and mutually reinforcing. Efforts to improve governance, environmental sustainability, economic performance, and cultural promotion can have synergistic effects, contributing to the overall achievement of sustainable development goals. However, it is important to note that correlation does not necessarily imply causation, and further analysis is required to understand the underlying causal mechanisms and potential trade-offs between these pillars.

Figure 2 compares the Cultural Sustainability Measurement Index (CSMI) among South Korea, China, and Japan from 1994 to 2023 and it reveals distinct trends in the cultural sustainability performance of these three countries. Japan consistently outperforms South Korea and China in terms of CSMI, indicating a stronger commitment to cultural sustainability. In contrast, China's CSMI is relatively lower, which may be attributed to various factors, including environmental issues.



<Figure 2> Contrast of CSMI among three countries

Japan's superior CSMI can be attributed to its robust cultural policies, significant investment in cultural heritage preservation, and a well-established framework for promoting cultural diversity. Japan has a long history of valuing and preserving its cultural heritage, which is reflected in its high CSMI scores. The country's commitment to cultural sustainability is evident in its continuous efforts to support cultural industries, promote traditional arts, and integrate cultural considerations into broader sustainability frameworks. Additionally, Japan's effective governance and economic stability have provided a conducive environment for cultural sustainability initiatives to thrive.

South Korea's CSMI shows a steady improvement over the years, reflecting the country's growing emphasis on cultural sustainability. South Korea has made significant strides in promoting

its cultural industries, such as K-pop, film, and traditional arts, which have gained international recognition. The government's proactive policies and investments in cultural infrastructure have contributed to the country's rising CSMI. However, South Korea still lags behind Japan, indicating room for further enhancement in cultural sustainability practices.

China's CSMI, despite its rich cultural heritage and diverse cultural landscape, can be partly attributed to environmental challenges and governance issues. The rapid industrialization and economic growth in China have often come at the expense of environmental sustainability, leading to pollution and degradation of natural resources. These environmental issues have had a negative impact on cultural sustainability, as many cultural practices and heritage sites are closely linked to the natural environment. Additionally, China's governance framework may not be as effective in promoting cultural sustainability compared to Japan and South Korea, further contributing to its lower CSMI.

The line graph highlights the varying levels of cultural sustainability among South Korea, China, and Japan. Japan's high CSMI reflects its strong commitment to preserving and promoting cultural heritage, while South Korea shows steady progress in cultural sustainability. China's CSMI points to the need for addressing environmental and governance challenges to enhance its cultural sustainability performance. These insights provide valuable lessons for policymakers and stakeholders in developing targeted strategies to improve cultural sustainability across different contexts.

5. Conclusion

This research paper examines the concept of cultural sustainability as a component of sustainable development, alongside the traditional pillars of economic, social, and environmental sustainability. By developing and applying the Cultural Sustainability Measurement Index (CSMI) to South Korea, China, and Japan, a comprehensive analysis is provided of the cultural sustainability performance of these countries over the period from 1994 to 2023.

The correlation analysis conducted in this study revealed strong positive relationships between the four pillars of sustainability: cultural, economic, governance, and environmental. The high correlation coefficients suggest that efforts to improve one pillar can have synergistic effects on the others, reinforcing the interconnectedness of these dimensions. This finding emphasizes the need for a holistic and integrated approach to sustainable development, where cultural sustainability is recognized as a crucial component that cannot be addressed in isolation.

Furthermore, our findings indicate that Japan consistently outperforms South Korea and China in terms of CSMI, reflecting its robust cultural policies, significant investment in cultural heritage preservation, and effective governance frameworks. Japan's high CSMI scores reflect its commitment to maintaining and promoting cultural heritage, diversity, and identity, which are crucial for sustainable development.The country's ability to integrate cultural considerations into broader sustainability strategies has contributed to its overall success in achieving higher levels of cultural sustainability.

South Korea has shown steady improvement in its CSMI, highlighting the country's growing emphasis on cultural sustainability. The government's proactive policies and investments in cultural industries, such as K-pop and traditional arts, have played a significant role in this progress. However, South Korea still lags behind Japan, indicating that there is room for further enhancement in cultural sustainability practices to achieve a more balanced and integrated approach to sustainable development.

China's CSMI, while relatively lower compared to Japan and South Korea in this comparative analysis, exhibits a consistent upward trajectory, reflecting the country's efforts towards achieving cultural sustainability. However, it is crucial to acknowledge that China's rich cultural heritage and diversity present both opportunities and challenges in this regard. The relatively low CSMI score for China can be attributed to several factors, primarily environmental concerns and governance-related challenges. China's rapid industrialization and economic growth have often come at the cost of environmental sustainability, leading to issues such as pollution, degradation of natural resources, and loss of biodiversity. These environmental challenges have had a direct impact on cultural sustainability, as many cultural practices and heritage sites are intrinsically linked to the natural environment.

This study highlights the importance of cultural sustainability as a critical dimension of sustainable development. The CSMI provides a valuable tool for assessing and comparing cultural sustainability across different countries, offering insights and recommendations for policymakers, cultural organizations, and stakeholders. Recognizing the interconnectedness of cultural, economic, governance, and environmental factors enables the development of more holistic and integrated strategies. These strategies can promote the preservation and continuation of cultural heritage, diversity, and expressions, contributing to the overall sustainability of societies.

This study also adds to the literature on sustainability by enhancing the understanding of cultural sustainability and its interconnectedness with economic, governance, and environmental dimensions. The development of the Cultural Sustainability Measurement Index (CSMI) offers a framework for assessing cultural sustainability, a dimension that has often been less emphasized in broader sustainability discussions. The results suggest the value of integrating cultural considerations into sustainability policies, supporting the view that culture is a key factor in achieving long-term, sustainable development. Additionally, the findings indicate that sustainability theories could benefit from further development to incorporate the cultural dimension, which interacts with and complements the other pillars of sustainability.

Based on the findings, it is suggested that policymakers in countries with lower CSMI scores, such as China, consider integrating cultural sustainability into their environmental and economic policies. This might involve prioritizing the preservation of cultural heritage sites that are closely linked to the natural environment, as well as promoting cultural practices that contribute to environmental sustainability. For countries like South Korea, which show promising progress, a potential next step could be increasing investment in cultural infrastructure and diversifying cultural expressions to further strengthen the cultural sector. Japan's success offers insights for

other countries, highlighting the importance of comprehensive, long-term cultural policies, strong governance frameworks, and continued investment in cultural heritage preservation.

Future research could further investigate the potential causal relationships between cultural sustainability and the other pillars of sustainability, exploring how changes in one pillar might influence others. Additionally, applying the CSMI framework to other countries or regions, particularly those in the Global South, could help to better understand the specific challenges and opportunities they encounter in achieving cultural sustainability. Research might also explore the role of particular cultural practices or industries—such as arts, crafts, and traditional knowledge—in contributing to sustainable development, particularly in the context of climate change and rapid globalization. Finally, expanding the scope of the CSMI to incorporate social dimensions, such as gender and community participation, may offer a more comprehensive measure of cultural sustainability in relation to human well-being.

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