Navigating Nexus: Cross-Mapping Sustainable Development Goals and Competitiveness for a Resilient Future

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Navigating Nexus: Cross-Mapping Sustainable Development Goals and Competitiveness for a Resilient Future

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Abstract

This study investigates two established sustainability metrics—the Sustainable Development Goal Index (SDGI) and the Global Sustainable Competitiveness Index (GSCI)—to explore dependencies between their associated drivers using Bayesian Belief Networks (BBNs). The analysis considers sustainability performance data for 163 countries in 2023, using data from SolAbility's Sustainable Competitiveness Report and the Sustainable Development Report. The predictive accuracy of the models used in this study is 85.1% for the SDGI and 70.6% for the GSCI for the two extreme states. Key findings underscore the strong interdependence between social and economic SDG dimensions and GSCI, whereas the environmental dimension appears relatively isolated in its contribution toward overall competitiveness. The study identifies key sustainable competitiveness pillars such as governance, social capital, and intellectual capital, highlighting their significant impact on SDGI outcomes. The results reveal that high competitiveness does not uniformly translate to high performance across all sustainability dimensions—with notable disparities in terms of environmental performance. Similarly, strong SDGI performance does not guarantee excellence in sustainable competitiveness. Scenario analysis reveals that high performance in 'governance', 'social capital', and 'intellectual capital' yields a 100% probability of achieving high SDGI performance. Moreover, high performance across the economic, social and environmental SDG dimensions ensures a 52% probability of achieving high sustainable competitiveness. BBNs reveal complex interrelationships among SDG dimensions and the various pillars of sustainable competitiveness, offering a more integrated and holistic approach compared to traditional methods. The proposed approach allows for the identification of critical drivers and offers a framework for scenario analysis, which can inform targeted policymaking and business strategies aimed at enhancing sustainability performance.

Keywords: Bayesian Belief Network, competitiveness, governance, SDGs, sustainability.

JEL Classification: C44

1. Introduction

Sustainability is the ability to meet the needs of the present generation, without compromising the ability of future generations to meet their own needs (Çifçi and Sönmez, 2023). The term encompasses the responsible use of resources, environmental protection, social equity, and economic viability. As global challenges such as climate change, biodiversity loss, and resource depletion intensify, sustainability has emerged as a critical concern worldwide. Natural capital, including ecosystems, land, water, and air, and the foundation of all environmental sustainability, is vital for sustaining life and human well-being (Mahdian *et al.*, 2024; Malekmohammadi *et al.*, 2023). Recent research has shown that the mismanagement and deterioration of this natural capital has cascading effects across ecosystems, economies, and societies. These environmental losses

disproportionately affect vulnerable regions, causing disruptions in agriculture, water availability, human health, and economic stability. In particular, the degradation of wetlands, forests, and biodiversity contributes to ecological imbalances that exacerbate socio-economic challenges such as poverty, inequality, and migration.

The significance of these issues is further underscored by the United Nations' Sustainable Development Goals (SDGs), a universal framework designed to address these pressing global challenges by 2030. The SDGs consist of 17 global objectives to ensure prosperity for all while protecting the planet (Yu and Huarng, 2024). These goals cover various issues, including poverty, hunger, health, education, gender equality, clean water, climate action, and partnerships for sustainable development. By aligning policies and practices with the SDGs, countries can aim to create an equitable and sustainable future. However, achievement of these goals requires comprehensive strategies that integrate environmental, social, and economic considerations at national and international levels. In parallel, sustainable competitiveness refers to the ability to generate wealth and improve the well-being of current and future generations without compromising the planet's natural resources or social equity (SolAbility, 2023).

The Sustainable Development Goal Index (SDGI) is an essential tool for assessing a country's progress toward the SDGs, providing a comprehensive evaluation of a country's performance in addressing global challenges related to poverty, inequality, climate change, and more (Qazi *et al.*, 2023). This index incorporates various indicators aligned with the SDGs, covering social, economic, and environmental dimensions (i.e., SDG dimensions) (Dawes, 2022). The SDGI not only serves as a benchmark for national progress but also has far-reaching implications for international cooperation, policy prioritization, and resource allocation, guiding countries toward achieving sustainable and inclusive growth.

The Global Sustainable Competitiveness Index (GSCI) evaluates countries' performance using over 190 indicators, categorized under development pillars, including: natural capital, resource intensity, social capital, intellectual capital, economic sustainability, and governance (Kostakis *et al.*, 2023). These indicators allow countries to assess their competitiveness in a rapidly changing world where sustainable development is key to long-term prosperity. 'Natural capital' evaluates the state of the natural environment, including resource availability and depletion levels (Dabbous *et al.*, 2023). 'Resource intensity' measures operational competitiveness in a world with resource constraints, emphasizing the effective use of available resources (Çifçi and Sönmez, 2023). 'Social capital' addresses aspects such as health, security, freedom, equality, and life satisfaction, playing a crucial role in facilitating development (Ng *et al.*, 2023). 'Intellectual capital' focuses on the ability to generate wealth and jobs through innovation and value-added industries in globalized markets (Januškaitė and Užienė, 2018). 'Economic sustainability' assesses the capacity to generate wealth through sustainable economic development, utilizing all potential avenues (Çifçi and Sönmez, 2023). And finally, governance provides a framework for sustained and sustainable wealth generation, encompassing resource allocation, infrastructure, and guidance on market and employment structures (Hassan *et al.*, 2020). These pillars allow countries to assess their competitiveness in a rapidly changing world where sustainable development is key to long-term prosperity.

While previous studies have explored the relative importance of SDGI- and GSCI-related drivers (Dawes, 2022; Mishchuk *et al.*, 2023; Qazi and Al-Mhdawi, 2024; Qazi *et al.*, 2023), few have examined the interrelationship between the drivers of these two metrics. Furthermore, limited

research has addressed how the SDG dimensions collectively influence the GSCI performance. An additional novelty of this study lies in its exploration of how the pillars of sustainable competitiveness can impact the SDGI performance, shedding light on their interconnections and offering a more holistic approach to assessing a nation's sustainability performance.

The objectives of this study are two-fold: First, to investigate how the different pillars of sustainable competitiveness, such as natural capital and resource efficiency, influence SDGI performance, and alternatively how the three SDG dimensions influence GSCI performance. Second, to examine how the relationships between SDG dimensions and sustainable competitiveness pillars can inform policy decisions and strategic interventions aimed at enhancing both sustainability and competitiveness at national and international levels. This integrated approach will offer valuable insights into how countries can address the challenges of achieving the SDGs while improving their competitiveness on the global stage.

By linking the SDG dimensions with the pillars of sustainable competitiveness, this study provides a framework for understanding the drivers of both indices and their mutual influence. It emphasizes that sustainable development cannot be achieved in isolation but requires the integration of environmental, economic, and social factors. For example, the efficient use of natural resources can directly contribute to the achievement of SDG 12 (responsible consumption and production), whereas improving social capital can enhance progress toward SDGs related to health, education, and gender equality. The remainder of this paper is structured as follows: A detailed review of relevant literature is provided in Section 2. The research methodology is described in Section 3. Results and implications are discussed in Section 4. Section 5 outlines directions for future research.

2. Literature review

The SDGs have become a central framework for global efforts toward a more sustainable and equitable future (Henderson and Loreau, 2023). The SDGI is a critical tool for assessing and measuring a country's progress toward these goals (Qazi *et al.*, 2023). Research in this area has primarily focused on developing and refining the SDGI methodology, exploring the relationships between the 17 SDGs and various socio-economic and environmental indicators (Biggeri *et al.*, 2019; Diaz-Sarachaga *et al.*, 2018).

The concept of sustainability, encompassing environmental stewardship, social inclusivity, and economic viability, has gained increasing attention (Ruggerio, 2021). Scholars have emphasized the need to integrate these three SDG dimensions for comprehensive assessments (Ranjbari *et al.*, 2021). In addition, sustainable competitiveness has emerged as a key concept, emphasizing a country's ability to generate wealth while considering environmental and social factors (Dabbous *et al.*, 2023). Research identifies critical pillars of sustainable competitiveness, including natural capital, resource intensity, social capital, intellectual capital, economic sustainability, and governance (Mishchuk *et al.*, 2022).

Empirical studies have explored the three SDG dimensions, revealing both challenges and successes. For example, Qazi *et al.* (2023) emphasize the interconnectedness of the goals, stressing the need for an integrated approach to address complex issues such as poverty, inequality, and climate change. Case studies demonstrate how different regions adapt the SDGs to their specific contexts, showcasing the framework's versatility (Malagó *et al.*, 2021). Furthermore, monitoring

and evaluation efforts, such as the Global Sustainable Development Report, provide valuable insights into progress and areas requiring attention (Sachs *et al.*, 2021).

Despite widespread support for the SDGs, critiques question their feasibility and implementation. Some argue that the goals are overly ambitious and lack clear enforcement mechanisms (Swain, 2018) while others highlight the challenge of balancing economic growth with environmental sustainability, calling for a robust development approach (Hirai, 2022).

The GSCI draws from broader concerns relating to sustainable development and competitiveness. Scholars advocate for a holistic approach integrating economic, social, and environmental factors in assessing national competitiveness (Kara *et al.*, 2024). The GSCI aims to provide a comprehensive picture beyond traditional economic indicators (Kostakis *et al.*, 2023).

Empirical studies relating to GSCI have explored the relationship between sustainable competitiveness and economic performance (Ng *et al.*, 2023). Researchers examine how countries with higher GSCI scores demonstrate greater resilience to environmental challenges, improved social cohesion, and enhanced innovation capacity (Dabbous *et al.*, 2023; Mishchuk *et al.*, 2023). Case studies of countries with high competitiveness rankings offer insights into best practices for achieving sustainable competitiveness (Despotovic *et al.*, 2019; Thore and Tarverdyan, 2016).

Despite these advancements, a significant research gap remains in terms of understanding the linkages between SDG dimensions and sustainable competitiveness pillars, particularly within the context of the SDGI. While studies have explored these components independently, there is insufficient research examining how sustainable competitiveness pillars directly contribute to or hinder the achievement of specific SDGs. Understanding these interconnections is essential for policymakers, businesses, and researchers aiming to develop targeted and competitive strategies for sustainable development.

Furthermore, the existing literature lacks a unified approach to integrating sustainability dimensions into the assessment of sustainable competitiveness pillars and their impact on the SDGI. Bridging this gap would improve our understanding of the synergies and trade-offs between economic competitiveness and sustainability, facilitating more informed decision-making in pursuit of global development goals.

3. Research methodology

This study adopted a comprehensive methodology for developing and validating two data-driven Bayesian Belief Network (BBN) models. This section outlines the methodology adopted, covering the basics of BBNs, the data utilized, descriptive statistics, correlation analysis, discretization, model development, and validation techniques, including *k*-fold cross-validation.

3.1 Bayesian Belief Networks

BBNs are probabilistic graphical models that represent dependencies among variables using directed acyclic graphs. The core strength of BBNs lies in their ability to model complex, uncertain systems and capture causal and statistical relationships among variables. BBNs outperform other modeling techniques in several ways. First, BBNs provide a probabilistic representation, accommodating uncertainties and incomplete information inherent in complex systems (Simsekler and Qazi, 2022). Second, BBNs allow for the identification of causal relationships or statistical

dependencies among variables, contributing to a deeper understanding of underlying mechanisms (Cooper *et al.*, 2023). Third, BBNs serve as effective decision support systems, offering insights for optimal decision-making in various domains (Meng *et al.*, 2022). Moreover, the flexibility of BBNs enables easy updates with new data, making them adaptable to changes in the underlying system over time (Yang *et al.*, 2022).

In this study, two BBN models were developed to analyze the statistical relationships between sustainability development and sustainable competitiveness. The SDGI and the GSCI were selected as target variables.

3.2 Data and dataset description

The datasets used for this study were sourced from the Sustainable Development Report 2023 (SDG, 2023) and the Global Sustainable Competitiveness Report 2023 (SolAbility, 2023), providing insights into the performance of countries across various sustainability dimensions. The complete dataset is provided in the Appendix to this manuscript for further reference.

Table 1 provides the descriptive statistics of the variables analyzed in this study. These include the overall SDGI, individual SDG dimensions (i.e., economic, social, and environmental SDGs), the overall GSCI, and the various pillars of sustainable competitiveness (i.e., natural capital, resource intensity, social capital, intellectual capital, economic sustainability, and governance). The mean SDGI score is 67.7 with a maximum value of 86.8, indicating significant variation in SDGI performance across countries. Environmental SDGs displayed lower variance (44.0), indicating that performance in this area is more consistent across countries. Among the competitiveness pillars, governance has the highest mean value (51.6), whereas intellectual capital showed the highest variance (133.8), suggesting greater disparity in performance across countries.

Tab. 1 – Descriptive statistics. Source: own research

Variable	Mean	Variance	Std Dev	Min	Max	Count
Overall SDGI Score	67.7	106.2	10.3	38.7	86.8	163
Economic SDGs Dimension	65.8	298.9	17.3	19.2	92.0	163
Social SDGs Dimension	66.4	201.1	14.2	27.3	94.5	163
Environmental SDGs Dimension	70.7	44.0	6.6	48.3	82.4	163
Overall GSCI Score	44.0	44.8	6.7	32.1	59.6	163
Natural Capital Pillar	44.6	62.7	7.9	25.7	62.4	163
Resource Intensity Pillar	40.8	70.7	8.4	18.9	59.6	163
Social Capital Pillar	44.1	102.8	10.1	23.8	65.8	163
Intellectual Capital Pillar	40.9	133.8	11.6	21.7	75.2	163
Economic Sustainability Pillar	41.8	43.9	6.6	27.2	56.5	163
Governance Pillar	51.6	126.5	11.2	26.2	76.0	163

Table 2 presents the correlation matrix among the variables examined in the study. The SDGI score shows strong correlations between economic SDGs, social SDGs, the GSCI, and also with the social capital, intellectual capital, and governance pillars of sustainable competitiveness. Conversely, environmental SDGs, and the natural capital and resource intensity pillars show relatively weaker correlations with other variables, indicating that these drivers function somewhat independently of the others.

Tab. 2 – Correlation matrix. Source: own research

Variable	1	2	3	4	5	6	7	8	9	10	11
Overall SDGI Score (1)	-										
Economic SDGs Dimension (2)	0.95**	-									
Social SDGs Dimension (3)	0.95**	0.89**	-								
Environmental SDGs Dimension (4)	0.35**	0.12	0.15*	-							
Overall GSCI Score (5)	0.83**	0.79**	0.81**	0.26**	-						
Natural Capital Pillar (6)	0.26**	0.15	0.19*	0.45**	0.45**	-					
Resource Intensity Pillar (7)	-0.06	-0.09	-0.04	0.06	0.35**	0.18*	-				
Social Capital Pillar (8)	0.85**	0.82**	0.86**	0.16*	0.85**	0.19*	0.05	-			
Intellectual Capital Pillar (9)	0.80**	0.84**	0.78**	0.06	0.82**	0.12	0.04	0.73**	-		
Economic Sustainability Pillar (10)	0.62**	0.57**	0.57**	0.32**	0.81**	0.41**	0.33**	0.60**	0.58**	-	
Governance Pillar (11)	0.88**	0.85**	0.88**	0.16*	0.90**	0.25**	0.08	0.87**	0.79**	0.66**	-

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

3.3 Discretization and model development

The data was discretized into three distinct states for each variable, based on a uniform-width discretization scheme (Simsekler and Qazi, 2022). This classification system defined low, medium, and high states, allowing each variable to be represented as a discrete set of performance categories. Two models were developed in GeNIe software using the Augmented Naive Bayes (ANB) algorithm. In these models, the SDGI and GSCI were selected as the target variables. The ANB algorithm extends the traditional Naive Bayes approach by addressing its limitation of assuming independence among features (Al Nuairi *et al.*, 2023). While both algorithms share a foundation in Bayesian probability theory and are employed for classification tasks, Naive Bayes simplifies computations by assuming feature independence. In contrast, ANB introduces a mechanism to account for feature dependencies, allowing for a more nuanced representation of the data distribution. ANB acknowledges situations where the independence assumption may not hold, enhancing accuracy, particularly when features are correlated (BayesFusion, 2024).

Subsequently, parameter estimation was conducted using Maximum Likelihood Estimation (MLE) to estimate the conditional probability tables for each node in the network (BayesFusion, 2024). This approach ensures that the relationships among variables are accurately modeled.

3.4 Model validation

To validate the model, *k*-fold cross-validation was used (Marcot and Hanea, 2021). *K*-fold cross-validation is a robust technique used to assess the performance of predictive models by partitioning the dataset into *k* equal subsets or folds. The model is trained on *k-1* folds and tested on the remaining fold. This process is repeated *k* times, with each fold serving as the test set once. The results from each iteration are averaged to provide an overall estimate of model accuracy. This technique helps to reduce the risk of overfitting and ensures that the model's performance is generalizable to new data.

In this study, the validation results indicated an average predictive accuracy of 85.1% for the SDGI and 70.6% for the GSCI for the two extreme states. These results confirm the model's robustness, demonstrating its ability to make reliable predictions, even for extreme performance states.

Sensitivity analysis was also conducted to assess the impact of changes in the variable states on the model's predictions. This analysis helps to identify the most influential variables and understand how variations in input data can affect the output. The detailed results of the two BBN models and sensitivity analysis are discussed in the next section.

4. Results and discussion

4.1 BBN models

Figure 1 illustrates the statistical dependencies among the three SDG dimensions and the GSCI score. Notably, social sustainability and economic sustainability display interdependence, while environmental sustainability appears isolated from the other dimensions. Around 20% of the countries assessed demonstrate high performance in sustainable competitiveness, contrasting with 42% exhibiting low performance. Intriguingly, the countries under scrutiny showcase superior performance across the three sustainability dimensions compared to sustainable competitiveness. The arc thickness represents the strength of influence between interconnected variables, with the strongest association observed between the GSCI score and the social SDGs dimension. Conversely, the weakest link exists between the GSCI score and the environmental SDGs dimension.

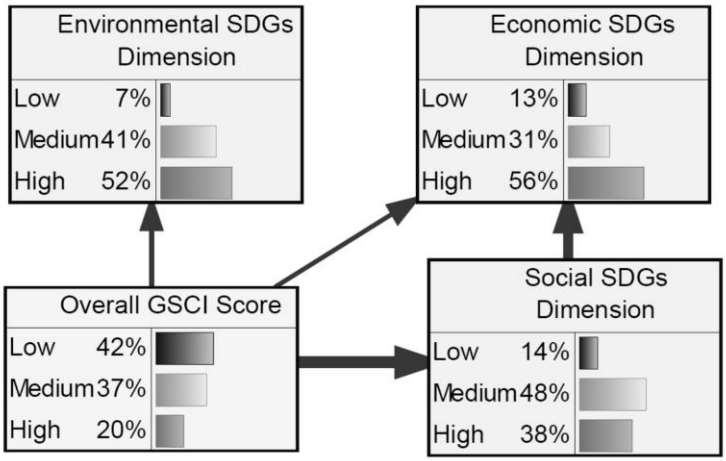


Fig. 1 – A BBN model linking GSCI score to SDG dimensions with arc thickness representing the strength of influence between interconnected variables (developed in GeNIe software). Source: own research

Figure 2 illustrates the statistical dependencies among the six pillars of sustainable competitiveness and the SDGI score. In the context of an ANB algorithm-based BBN model, the conventional direction of arcs, typically from the target variable to individual predictors, is reversed. This suggests that each predictor variable influences the target variable. A path connects 'intellectual capital', 'social capital', 'governance', 'resource intensity', 'economic sustainability', and the SDGI score. Almost 44% of the countries assessed exhibit a high SDGI score, whereas only 13% have a low score. Notably, among the sustainable competitiveness pillars, 'intellectual capital' is associated with the highest proportion of countries (50%) demonstrating low performance. The key pillars, ranked by their strength of influence on the target variable, are 'intellectual capital', 'governance', and 'social capital'.

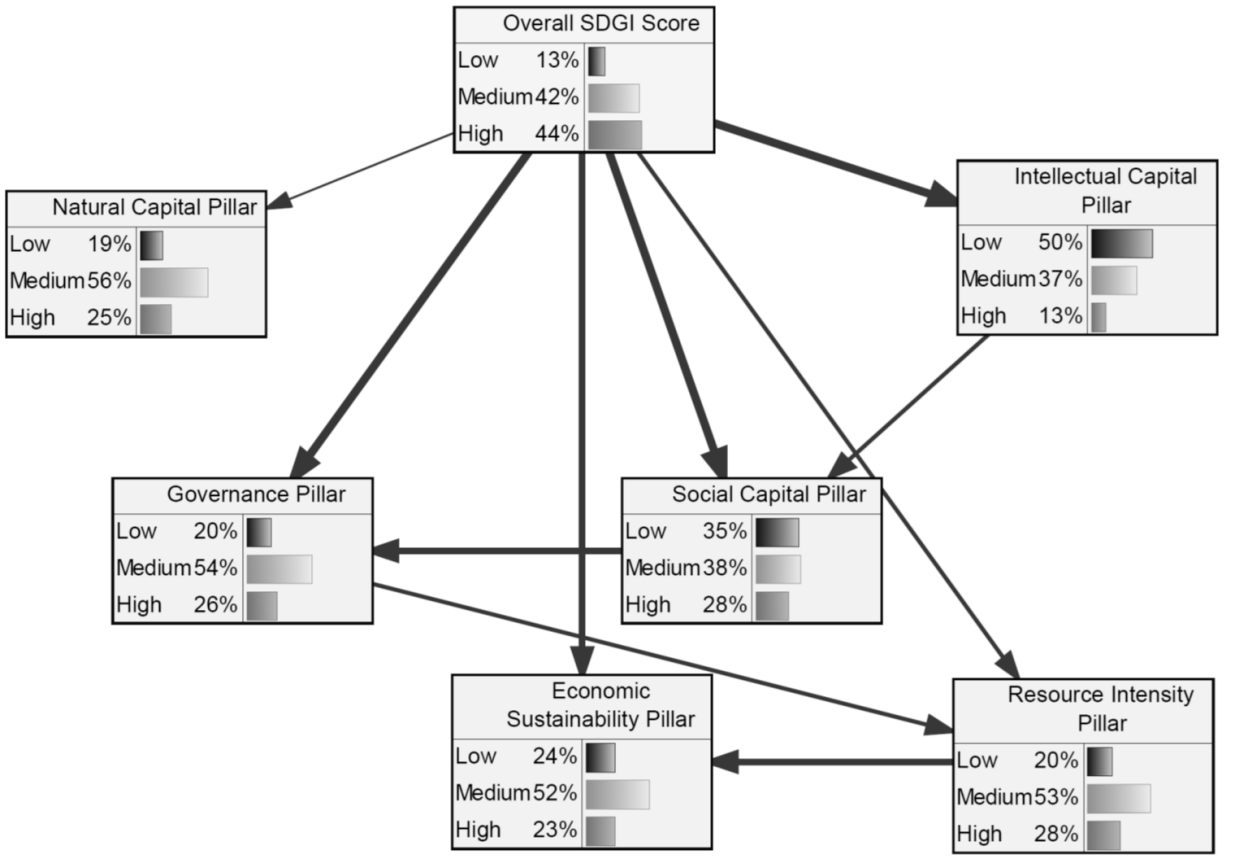
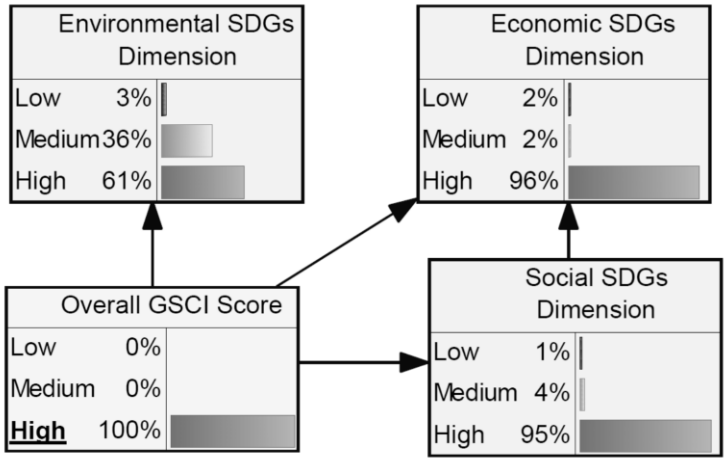


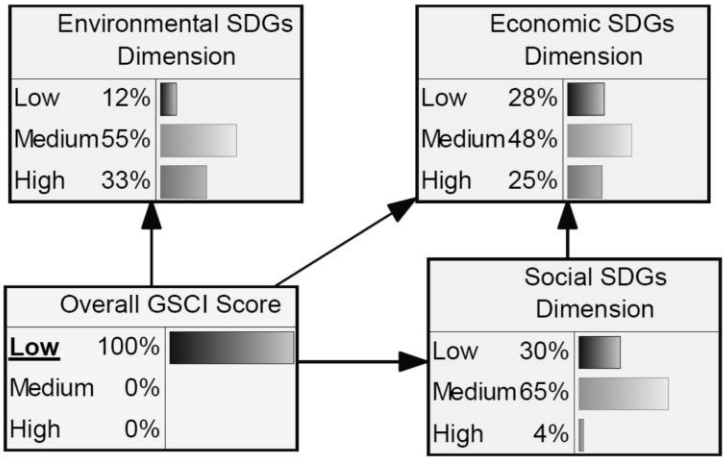
Fig. 2 – A BBN model linking the SDGI to sustainable competitiveness pillars with arc thickness representing the strength of influence between interconnected variables (developed in GeNIe software). Source: own research

4.2 Key findings

Figures 3 (a) and 3 (b) depict the performance of countries in specific SDG dimensions based on their levels of sustainable competitiveness. Countries with high GSCI performance also excel in economic and social SDGs, accompanied by moderate to high environmental SDGs performance with probabilities of 36% and 61%, respectively. Conversely, countries exhibiting low GSCI performance do not uniformly show low performance across all three sustainability dimensions; rather, they tend to demonstrate moderate performance.



(a)

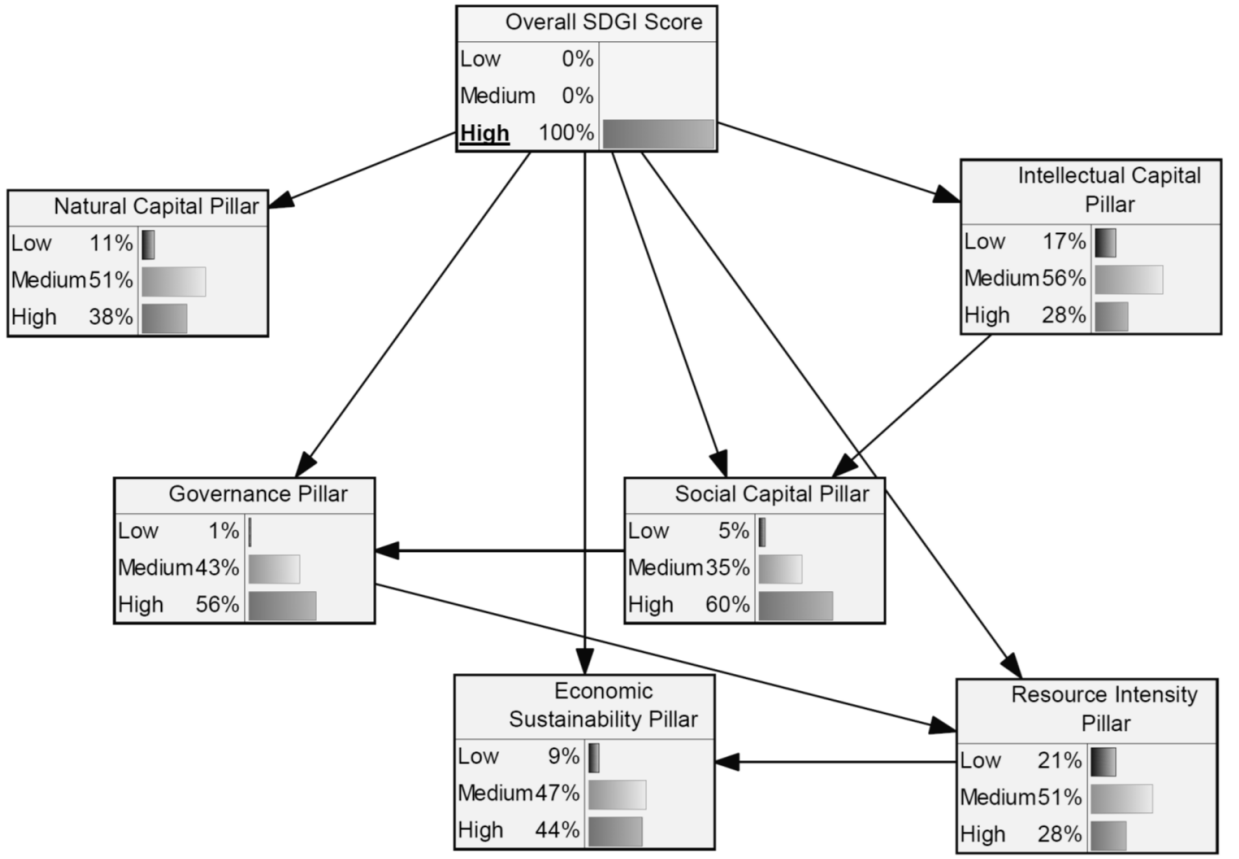


(b)

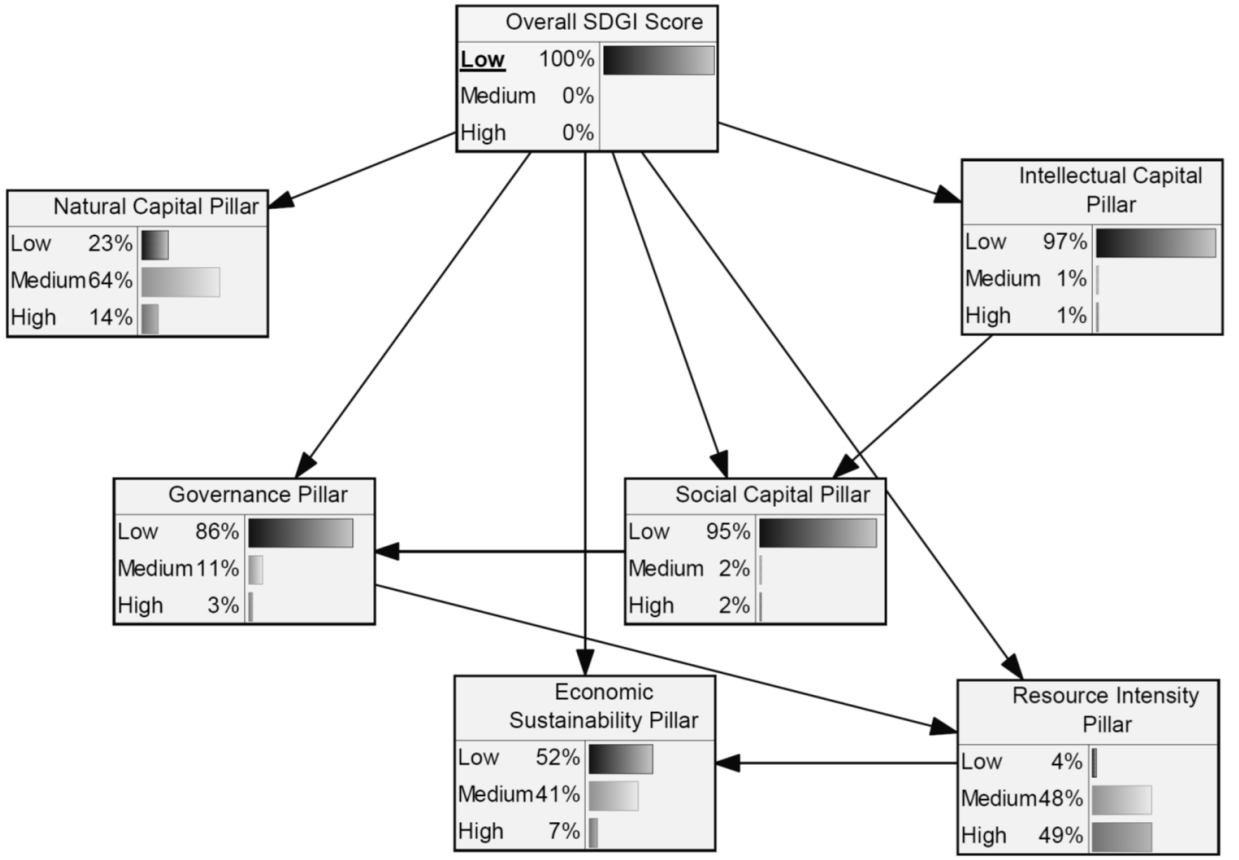
Fig. 3 – A BBN model representing the countries with (a) high; and (b) low sustainable competitiveness performance. Source: own research

Figures 4 (a) and 4 (b) showcase the performance of countries across specific sustainable competitiveness pillars, differentiating those with high and low SDGI scores. Countries with elevated SDGI scores generally exhibit moderate to high performance in 'governance' and 'social capital'. Notably, these nations are characterized by a 60% probability of achieving high

performance in ‘social capital’, whereas ‘intellectual capital’ and ‘resource intensity’ display the lowest probability at 28%. Conversely, a low SDGI score corresponds to diminished performance in ‘intellectual capital’, ‘social capital’, and ‘governance’.



(a)



(b)

Fig. 4 – A BBN model representing the countries with a (a) high; and (b) low SDGI score.
Source: own research

4.3 Relative importance of individual factors

To prioritize factors based on their influence on the SDGI and GSCI, the two extreme performance states of individual factors were chosen, and the resulting change in the probability of achieving the high-performance state for each target variable was evaluated. Figure 5 illustrates the relative importance of individual sustainable competitiveness pillars and their impact on the SDGI score. Among these pillars, 'governance', 'social capital', and 'intellectual capital' emerge as critical due to their significant influence on the SDGI score, whereas 'resource intensity' is identified as the least critical pillar.

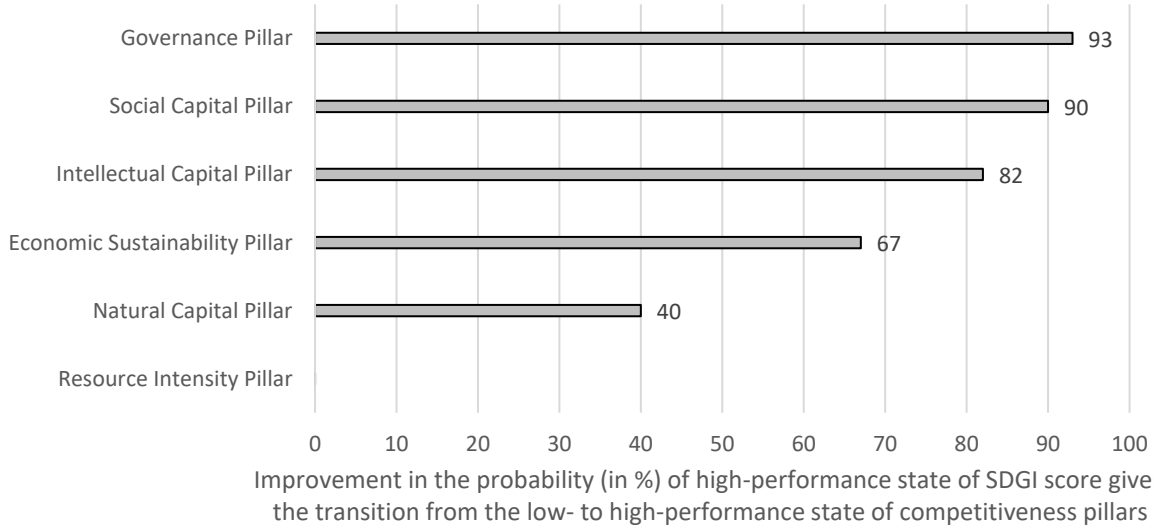


Fig. 5 – Relative importance of individual sustainable competitiveness pillars. Source: own research

Figure 6 illustrates the relative significance of individual SDG dimensions in terms of their influence on GSCI performance. 'Social sustainability' stands out as the most crucial dimension, while 'environmental sustainability' is considered the least critical. A close comparison of Figures 5 and 6 clearly emphasizes that the relative impact of individual sustainability dimensions on GSCI is considerably weaker compared to the influence of individual sustainable competitiveness pillars on the SDGI score.

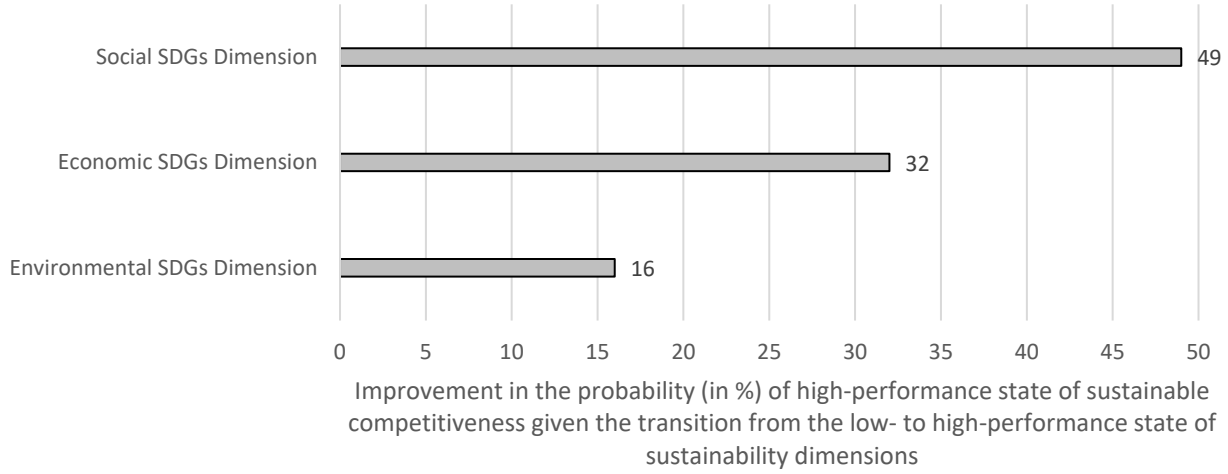


Fig. 6 – Relative importance of individual sustainability dimensions. Source: own research

4.4 Scenario analysis

Drawing from the insights obtained in the conducted sensitivity analysis (see Figure 5), various scenarios were generated to capture unique combinations of performance states for individual sustainable competitiveness pillars. Opting for a high-performance state in each of the 'governance', 'social capital', and 'intellectual capital' pillars resulted in the highest probability of achieving the high-performance state for the SDGI (i.e., 100%). While compromising the performance of either 'social capital' or 'intellectual capital' did not markedly alter the overall SDGI performance, any compromise in 'governance' significantly deteriorated the overall SDGI performance. This finding clearly illustrates the unlikelihood of achieving high performance on the SDGI when facing low performance in all three of the sustainable competitiveness pillars.

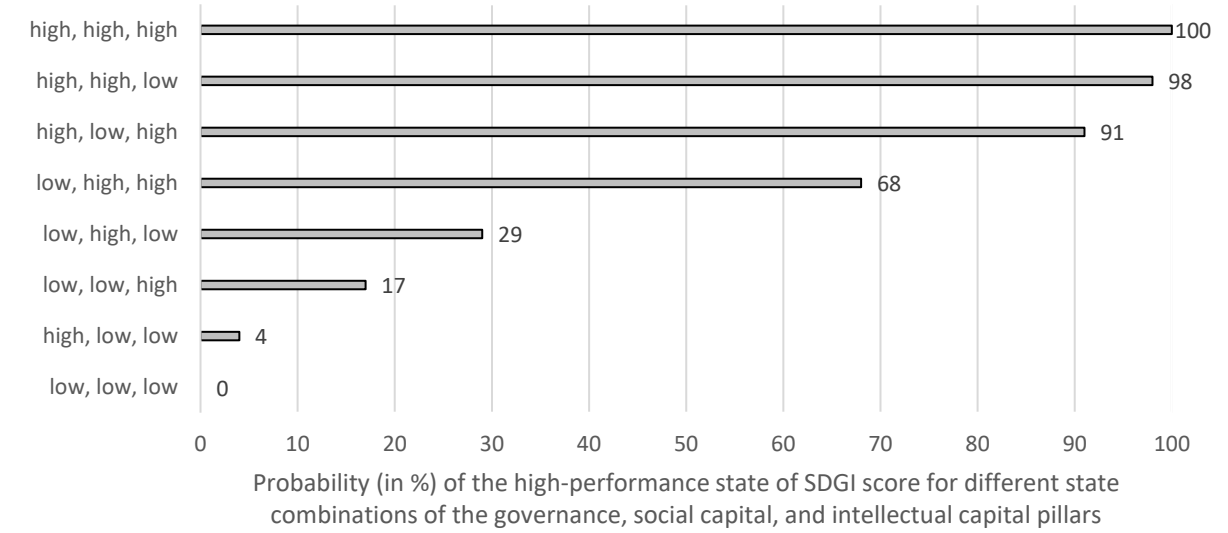


Fig. 7 – Scenario analysis for critical sustainable competitiveness pillars. Source: own research

Figure 8 visually presents the impact of eight scenarios, each reflecting distinct combinations of performance states for the three SDG dimensions in terms of their impact on sustainable competitiveness. Achieving high performance across all three SDG dimensions guarantees a probability of approximately 52% for achieving high GSCI scores. Conversely, experiencing low performance across all three dimensions significantly diminishes the likelihood of attaining high performance on the GSCI.

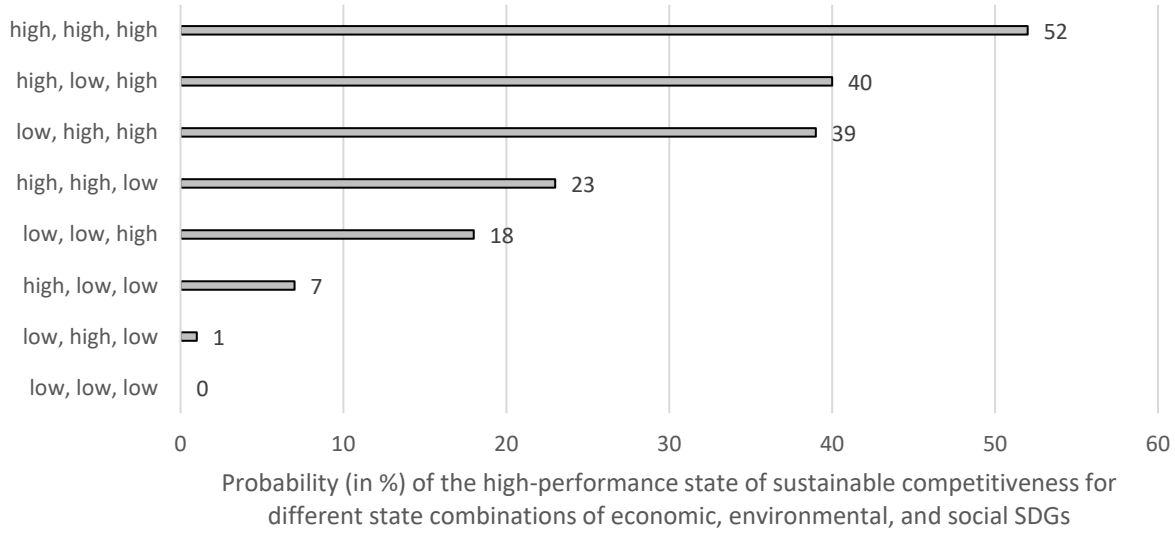


Fig. 8 – Scenario analysis for sustainability dimensions. Source: own research

4.5 Discussion

The findings of this study, derived from cross-mapping the drivers influencing both the SDGI and GSCI, reveal complex relationships. The first BBN model (see Figure 1) provides a comprehensive overview of the statistical dependencies among the three SDG dimensions and the GSCI. The disparities between high and low performance on the GSCI are significant, with only 20% of the countries demonstrating high performance contrasting with the 42% exhibiting low performance. The interdependence between the social and economic SDGs in this model is consistent with prior research (Qazi, 2024; Qazi and Al-Mhdawi, 2024), emphasizing the interconnectedness of these dimensions in fostering competitiveness. These findings also support the results of Kara *et al.* (2024), who found that countries with high levels of sustainable competitiveness excel in economic and social indicators. However, this study adds value by highlighting the environmental SDGs to be the least integrated dimension within the sustainable competitiveness framework, a trend less commonly explored in other models. This isolation might be attributed to the complexity of environmental factors and the challenges associated with their integration into broader sustainability initiatives.

The statistical dependencies among the six pillars of sustainable competitiveness and the SDGI score provide valuable insights into the factors influencing sustainability performance. The prominence of ‘intellectual capital’, ‘governance’, and ‘social capital’ as key pillars suggests that investments in education, institutional quality, and social cohesion are crucial for driving sustainable development. The high proportion of countries with low performance in ‘intellectual

capital' indicates potential challenges in innovation, research, and human capital development, which could hinder long-term sustainability efforts. Additionally, the observed relationships emphasize the interconnected nature of economic, social, and governance factors in shaping sustainable competitiveness. However, it is important to recognize that these statistical associations do not imply causality but rather reflect underlying dependencies among variables. Policymakers should consider these insights when designing strategies to strengthen the most influential pillars, ultimately enhancing national sustainability outcomes.

The findings provide a refined perspective on how countries' performance along specific SDG dimensions and competitiveness pillars varies with regard to SDGI and GSCI scores. Unlike previous studies that have often treated sustainability dimensions in isolation, this study emphasizes the need for a more integrated perspective. The interplay between these variables underscores the complex relationships between the economic, social, and environmental SDGs. Countries with high GSCI performance excel in economic and social SDGs, showcasing a comprehensive approach to sustainable development. In contrast, low GSCI performance does not uniformly translate to low performance across all SDG dimensions, indicating the possibility of achieving moderate sustainability results, even in the face of competitiveness challenges.

In Figure 5, the prioritization of factors influencing the overall SDGI reveals the critical roles of 'governance', 'social capital', and 'intellectual capital'. This is in line with Sabet and Khaksar (2024), who emphasized the centrality of governance and social capital in fostering sustainable development. However, our study expands on this by demonstrating that governance, social capital, and intellectual capital have greater impacts on SDGI outcomes than the traditional focus on economic sustainability. This highlights the importance of effective governance structures, social cohesion, and intellectual resources in advancing SDGs.

Figure 6 reveals the relative significance of individual SDG dimensions in influencing GSCI performance. While 'social sustainability' is the most influential dimension, 'environmental sustainability' is considered the least critical, implying social aspects play a more pivotal role compared to environmental considerations in the context of sustainable competitiveness. Interestingly, the overall impact of individual SDG dimensions on competitiveness is weaker than the influence of individual sustainable competitiveness pillars on the SDGI.

Insights from scenario analysis (see Figure 7) reveal situations in which compromising certain sustainable competitiveness pillars, particularly governance, significantly impacts the overall SDGI performance. The analysis clearly shows how a decline in governance quality deteriorates SDG outcomes, consistent with Ahmed and Anifowose (2024), but our study adds a novel finding by quantifying this impact within the context of the SDGI. The interdependence between these factors highlights the challenge of achieving high SDGI performance when critical pillars of sustainable competitiveness underperform.

The cross-mapping of drivers provides valuable insights into the interconnectedness between the three SDG dimensions, competitiveness pillars, and overall SDGI and GSCI achievements. The findings underscore the need for a holistic and integrated approach that considers not only economic and social factors but also the intricate interplay between 'governance', 'social capital', and 'intellectual capital'. Moreover, the study highlights that environmental sustainability, while essential, is less integrated into national competitiveness strategies compared to the other dimensions. This insight could inform environmental protection efforts, as it suggests that

integrating environmental considerations more thoroughly into governance structures and policy-making could enhance both sustainability and competitiveness outcomes.

The rationale for the study's findings lies in the complex and interconnected nature of the three SDG dimensions and their impact on sustainable competitiveness. The identification of statistical dependencies, particularly the interdependence of social and economic sustainability can be attributed to the complexities within these dimensions. The isolation of the environmental sustainability dimension is linked to historical challenges in integrating environmental concerns into national strategies, where economic and social policies have typically dominated. This suggests an opportunity for governments and international organizations to enhance environmental protection by fostering integrated policies that bridge this gap. While social and economic aspects often align with policy initiatives, environmental sustainability, with its unique challenges, may require specialized attention.

The unexpected result that achieving high sustainable competitiveness does not uniformly translate to high performance across all three SDG dimensions is noteworthy. This finding holds significant implications for environmental protection, suggesting that improving economic competitiveness does not necessarily lead to better environmental outcomes. This underscores the need for a targeted approach to enhancing environmental sustainability within broader national strategies. This discrepancy suggests that economic success may not guarantee comprehensive sustainability, highlighting the need for a robust approach to policymaking and strategic planning.

The prioritization of 'governance', 'social capital', and 'intellectual capital' as critical drivers of both the SDGI and GSCI aligns with growing recognition of the importance of governance structures, as well as social and intellectual resources, in driving sustainable development (Omri and Ben Mabrouk, 2020). The findings also highlight the need for stronger governance frameworks to facilitate environmental protection, as governance quality is a critical determinant of the success of both sustainable development and sustainable competitiveness efforts. This redefines conventional economic-centric models, indicating that the quality of governance, social capital, and intellectual capital plays a pivotal role in achieving holistic sustainability.

The observed phenomenon, whereby sustainable competitiveness pillars significantly influence the SDGI, while the SDG dimensions do not strongly correlate with the GSCI, can be attributed to several factors. First, the sustainable competitiveness pillars are specifically designed and measured to address economic, social, and environmental factors that directly impact competitiveness. In contrast, the SDGs have a broader scope, encompassing challenges such as poverty, inequality, climate change, and peace. The SDGI tracks progress toward these goals, which may not align perfectly with factors that contribute to a country's competitive advantage. Second, achieving the SDGs often requires long-term investments in areas such as education, healthcare, and sustainable development, which may not yield immediate economic benefits. In contrast, sustainable competitiveness pillars may focus on short to medium-term indicators influencing a country's competitive position. As a result, the impact of SDGs on competitiveness may take time to materialize. Third, countries may prioritize certain sustainable competitiveness pillars based on economic and developmental goals, such as investing in infrastructure and technology to enhance competitiveness while not fully addressing social issues covered by the SDGs. Moreover, the SDGs are multidimensional, making it difficult to establish a direct and linear relationship with a single metric like sustainable competitiveness.

4.6 Implications

The findings of this study contribute to theoretical advancements in sustainable development and competitiveness by revealing complex interdependencies and patterns. The identification of statistical dependencies among the SDG dimensions and sustainable competitiveness offers a better understanding of how economic, social, and environmental factors interact. The observed interdependence between social and economic sustainability, coupled with the relative isolation of environmental sustainability, redefines traditional models that often treat these dimensions independently. This calls for a more integrated theoretical framework that acknowledges the intricate relationships between sustainability-related drivers.

The prioritization of factors influencing both the SDGI and GSCI has theoretical implications for understanding the critical drivers of sustainable development. The emphasis on ‘governance’, ‘social capital’, and ‘intellectual capital’ as key drivers of the SDGI redefines traditional economic-centric models and highlights the need for a holistic and multidimensional theoretical framework.

The managerial implications of this study are multifaceted and offer practical insights for policymakers, businesses, and international organizations striving to enhance sustainability and competitiveness. The observed disparities in performance between sustainability dimensions and the pillars of sustainable competitiveness emphasize the need for integrated strategies. Policymakers must recognize that achieving economic competitiveness does not guarantee holistic sustainable development, necessitating a balanced approach that considers social and environmental dimensions.

The sensitivity analysis outcomes have significant managerial implications for decision-makers. Moreover, the scenarios generated highlight the importance of governance structures in influencing overall SDGI performance. Policymakers should prioritize strengthening governance frameworks to ensure the effective implementation of sustainable development initiatives. Furthermore, businesses and organizations seeking to contribute to sustainability goals must recognize the pivotal role of 'social capital' and 'intellectual capital' in driving positive outcomes.

The relative significance of individual SDG dimensions relative to sustainable competitiveness guides managerial decisions in resource allocation and strategy formulation. The dominance of 'social sustainability' underscores the importance of fostering social cohesion and inclusivity in business practices. While environmental sustainability remains crucial, the findings suggest that social aspects play a more pivotal role in influencing competitiveness outcomes.

In terms of the scenarios generated in this study, the managerial implication is clear: a comprehensive approach that strives for high performance across all sustainability dimensions is key to achieving sustainable competitiveness. Policymakers and business leaders should aim for a balanced strategy that addresses economic, social, and environmental aspects simultaneously to maximize the probability of high sustainable competitiveness.

This study’s theoretical and managerial implications underscore the need for a shift towards integrated and holistic approaches to sustainable development and competitiveness. Recognizing the interdependence of economic, social, and environmental factors, and prioritizing key drivers

identified in the study, will enable more effective policymaking and strategic decision-making for organizations committed to sustainable and competitive futures.

4.7 Contribution

This study makes several significant contributions to sustainable development and competitiveness by providing novel insights and advancing the current state of knowledge. The study contributes by integrating the three sustainability dimensions—economic, social, and environmental—within a comprehensive framework and visually representing the statistical dependencies among these dimensions and sustainable competitiveness. By revealing the interdependence of social and economic sustainability and the relative isolation of environmental sustainability, this study challenges siloed approaches and advocates for a more integrated model that considers these dimensions collectively. By prioritizing competitiveness pillars based on their influence on the SDGI score, the study identifies critical drivers. 'Governance', 'social capital', and 'intellectual capital' emerge as pivotal influencers, redefining traditional economic-centric models (Reyes and Useche, 2019). Moreover, this study demonstrates the novel application of BBNs in this unique context.

This study also provides insights that can guide environmental protection efforts, specifically suggesting that enhancing governance and integrating environmental sustainability into national competitiveness frameworks will foster both environmental and economic benefits. The findings challenge simplistic assumptions by revealing that low sustainable competitiveness does not uniformly translate to low performance across all sustainability dimensions. This nuanced perspective informs a more sophisticated approach to policymaking and strategic planning. The study conducts sensitivity analysis and investigates potential scenarios, providing practical tools for decision-makers. These analytical methods contribute to a deeper understanding of the potential impact of compromising on specific sustainability pillars and guide the formulation of robust strategies. The scenarios generated emphasize the importance of a comprehensive approach that considers high performance across all sustainability dimensions to achieve sustainable competitiveness.

5. Conclusions

This study has explored the relationships between sustainability dimensions, represented by economic, social, and environmental SDGs, and sustainable competitiveness. Through a comprehensive analysis of statistical dependencies, prioritization of critical drivers, and scenario analysis, the study has contributed novel insights by linking these three sustainability dimensions with achievement of sustainable competitiveness, a relationship that has remained largely unexplored in the existing literature. The findings underscore the need for an integrated approach that goes beyond traditional economic-centric models, recognizing the interdependence of various factors shaping sustainable development outcomes. This integrated approach highlights the importance of holistic sustainability frameworks, combining environmental, economic, and social dimensions to enhance long-term competitiveness and resilience. While the interdependence between social and economic sustainability aligns with prior research (Qazi, 2024), this study adds value by highlighting the complex challenges in integrating environmental sustainability into broader sustainability frameworks.

The key findings emphasize the critical role of governance, social capital, and intellectual capital pillars in influencing SDG outcomes. These drivers are shown to have a greater impact than traditional economic capital, aligning with the findings of Sabet and Khaksar (2024) and redefining conventional economic-centric models. The study also reveals significant disparities in performance, where countries with high sustainable competitiveness outperform in social and economic SDGs, yet this does not uniformly translate into high environmental sustainability performance. This misalignment echoes the findings by Qazi and Al-Mhdawi (2024) and underscores the importance of addressing specific sustainability pillars, such as intellectual capital and governance, to improve overall competitiveness and SDGI scores.

The study has certain limitations. First, the reliance on secondary data sources may not fully capture the dynamic and evolving nature of sustainability efforts in different countries. Second, the use of BBNs, while effective in modeling dependencies, does not account for causal relationships between variables in this context, which limits our ability to draw definitive conclusions about the direction of influence among sustainability dimensions and competitiveness. Additionally, the statistical methods and scenario analysis used may not fully account for qualitative factors, such as cultural, political, and contextual influences, which can significantly affect outcomes. These limitations suggest the need for further research that integrates longitudinal studies and causal analysis to provide deeper insights into the temporal and directional dynamics of sustainability and competitiveness.

Future research could explore several avenues. First, longitudinal studies that analyze the temporal dynamics of sustainability dimensions and their impact on competitiveness would provide valuable insights into how these relationships evolve over time and in response to global changes. Such studies could also explore causal relationships between the variables, adding depth to our understanding of how sustainability drivers interact. Additionally, sector-specific analyses could offer a more granular understanding of how different industries contribute to and respond to sustainability challenges. This could guide targeted interventions for specific sectors and provide policy recommendations tailored to particular industries.

Comparative studies across regions can illuminate more localized variations in the relationships between sustainability and competitiveness, addressing geopolitical, economic, and cultural differences that influence the effectiveness of sustainability initiatives. Such studies could inform context-specific policies that are culturally sensitive and responsive to local needs. Further, incorporating stakeholder perspectives—from businesses, communities, and policymakers—into sustainability models could offer a more inclusive and collaborative approach to achieving SDGs. Understanding the perceptions and contributions of various stakeholders can ensure that sustainability strategies are participatory and holistic.

Moreover, advancements in modeling techniques, particularly the integration of artificial intelligence and machine learning, can enhance the accuracy and predictive capabilities of sustainability and competitiveness models. These innovative approaches could refine our understanding of the nonlinear relationships and complex feedback loops within sustainability frameworks, offering more dynamic and adaptable models to inform policy decisions. Exploring innovative methods to capture these complex phenomena will be crucial in addressing the growing challenges of sustainability in a rapidly changing global landscape.

Implementation of this study's results could be highly beneficial for similar problems, particularly in contexts where sustainability and competitiveness are key priorities. Policymakers and decision-makers can adopt the findings to inform policy design by recognizing the critical roles of governance, social capital, and intellectual capital in shaping sustainable outcomes. Additionally, businesses and organizations can apply the prioritization of factors in sustainability strategies to enhance their competitiveness while contributing to SDGs. The study's methodology, particularly its use of scenario analysis, can be applied to other domains to model the impact of various factors on desired outcomes, helping stakeholders anticipate potential challenges and opportunities in achieving sustainability goals.

Appendix

<Attach the supplementary file here>

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Appendix

Tab. A1 – Sustainability ranking of countries. Source: SolAbility (2023); SDG (2023)

Country	SDG index score	Economic SDGs	Social SDGs	Environmental SDGs	Sustainable competitiveness	Natural capital	Resource Intensity	Social capital	Intellectual capital	Economic sustainability	Governance
Afghanistan	49.0	29.2	36.4	71.1	33.8	40.7	42.1	26.4	23.5	32.9	37.0
Albania	73.5	69.9	73.3	76.7	49.8	57.6	40.0	57.3	39.6	50.7	53.9
Algeria	70.8	70.8	69.5	72.2	37.8	38.9	26.9	43.9	41.5	32.1	43.5
Angola	50.8	39.2	41.0	70.3	38.3	47.9	49.4	28.6	25.8	44.5	33.9
Argentina	73.7	76.0	72.1	73.3	47.5	52.1	42.0	49.2	41.8	45.5	54.1
Armenia	73.3	69.4	75.1	76.4	44.3	39.9	28.7	60.7	39.3	39.1	58.2
Australia	75.9	86.4	82.4	60.6	52.3	46.2	52.7	51.7	53.5	42.6	67.0
Austria	82.3	89.0	88.1	71.7	56.2	49.0	47.0	58.0	59.6	56.3	67.3
Azerbaijan	73.5	70.1	77.5	73.8	39.1	42.0	27.7	44.6	42.0	33.4	44.7
Bahamas	60.9	66.9	61.1	57.7	37.7	31.2	39.8	34.7	35.5	40.5	44.3
Bahrain	63.7	74.7	61.3	52.4	36.6	33.9	29.6	38.6	37.8	36.7	43.2
Bangladesh	65.9	65.2	61.1	71.3	39.6	42.5	39.9	37.0	36.3	35.5	46.6
Belarus	77.5	73.7	82.7	77.5	46.3	54.4	35.2	52.5	38.0	45.0	52.8
Belgium	79.5	89.1	87.4	63.5	51.7	31.2	44.1	59.1	59.1	47.7	69.2
Belize	64.6	61.9	64.0	72.5	43.5	48.3	52.1	32.5	37.7	47.9	42.5
Benin	55.1	53.3	48.0	63.7	39.1	37.9	42.2	36.3	31.1	43.6	43.7
Bhutan	72.3	68.2	73.5	77.4	44.3	59.7	32.1	44.0	37.9	33.0	59.4
Bolivia	68.9	66.5	65.4	76.1	44.2	58.7	40.2	45.8	36.8	38.8	44.8
Bosnia and Herzegovina	74.0	72.9	69.6	79.3	46.4	54.3	34.5	51.9	34.0	47.9	55.5
Botswana	62.7	55.7	59.4	73.1	40.2	39.4	41.0	33.1	30.0	42.1	55.2
Brazil	73.7	76.9	64.8	79.9	44.8	59.2	42.0	35.9	41.9	40.0	49.9
Brunei Darussalam	65.7	72.1	77.2	48.3	40.4	39.2	38.2	42.9	36.0	39.1	47.0
Bulgaria	74.6	79.2	69.3	76.1	47.9	50.1	35.6	49.0	38.8	47.6	66.2
Burkina Faso	52.4	44.9	42.1	69.7	36.3	40.3	40.1	31.6	32.0	37.4	36.2
Burundi	53.9	35.0	55.3	68.6	36.6	41.5	46.1	37.7	30.8	30.5	32.7
Cabo Verde	68.8	61.0	71.5	72.7	38.9	29.4	37.3	43.0	29.8	45.3	48.7
Cambodia	64.8	57.0	60.8	69.6	41.0	52.4	35.2	36.9	28.5	44.3	48.7
Cameroon	55.1	50.0	41.8	72.8	40.0	48.6	47.4	33.8	34.4	42.4	33.3
Canada	78.5	85.8	87.5	63.4	53.1	59.3	44.7	52.3	55.7	43.4	63.4
Central African Republic	40.4	22.6	27.3	68.7	36.5	48.9	54.0	25.9	23.6	39.8	27.0
Chad	45.3	33.0	37.0	63.5	36.8	47.3	44.9	33.3	24.4	35.2	35.9
Chile	78.2	83.1	73.7	78.7	48.6	53.4	40.3	45.9	49.1	41.3	61.7
China	72.0	84.8	65.7	67.7	51.0	40.6	34.8	51.4	68.8	52.0	58.5
Colombia	70.1	69.2	64.7	76.2	46.6	58.5	40.6	36.4	47.1	46.6	50.5

Country	SDG index score	Economic SDGs	Social SDGs	Environmental SDGs	Sustainable competitiveness	Natural capital	Resource Intensity	Social capital	Intellectual capital	Economic sustainability	Governance
Comoros	51.7	43.5	44.1	66.2	35.1	34.4	46.7	31.1	27.6	34.3	36.2
Congo, Dem. Rep.	48.6	33.8	40.0	69.5	41.9	55.9	55.1	30.3	26.7	48.2	34.9
Costa Rica	73.6	74.0	72.0	74.7	49.3	47.2	48.3	49.3	39.9	51.7	59.7
Cote d'Ivoire	62.3	58.4	53.1	74.7	41.1	49.0	43.7	38.5	33.0	38.4	44.1
Croatia	81.5	83.6	78.9	82.4	52.9	55.6	44.2	55.8	46.4	50.7	64.7
Cuba	74.1	69.8	77.8	79.4	41.6	42.5	43.0	39.4	40.1	35.1	49.8
Cyprus	72.5	79.1	74.5	65.0	48.0	32.7	44.2	56.1	50.6	41.7	63.0
Czechia	81.9	84.8	85.9	77.3	54.7	48.1	42.6	59.2	55.2	55.4	67.5
Denmark	85.7	90.0	92.3	75.5	57.6	48.3	53.9	59.9	60.5	50.4	72.4
Djibouti	52.7	51.8	48.1	58.0	36.9	36.1	45.7	29.4	33.4	38.3	38.3
Dominican Republic	72.1	71.9	66.0	78.5	41.9	40.4	36.6	41.7	37.4	43.5	52.0
Ecuador	70.4	69.0	64.3	77.8	46.6	49.9	40.1	46.3	44.2	45.7	53.4
Egypt	69.6	69.1	66.2	73.5	36.7	36.8	33.2	33.1	37.7	34.5	45.0
El Salvador	70.7	68.0	70.1	73.5	43.8	45.7	51.1	45.2	29.1	45.8	45.6
Estonia	81.7	83.6	85.1	76.6	56.7	53.6	44.3	61.0	55.0	50.3	76.0
Eswatini	57.9	41.1	59.6	70.9	36.9	37.4	35.5	24.7	37.3	41.5	45.1
Ethiopia	54.5	48.3	48.7	65.5	39.0	38.8	47.3	36.9	28.3	41.2	41.1
Fiji	72.9	67.1	78.0	72.5	46.1	51.6	45.3	37.7	43.8	44.5	53.6
Finland	86.8	87.7	91.2	81.5	59.4	53.5	50.1	65.8	61.4	54.4	71.2
France	82.0	88.7	85.8	72.8	54.4	45.9	49.8	57.2	61.6	46.6	65.2
Gabon	63.1	58.7	51.7	78.2	41.8	45.6	47.0	33.8	33.3	47.7	43.5
Gambia	58.3	49.2	52.2	72.0	39.4	34.5	49.1	37.0	35.4	33.9	46.3
Georgia	75.0	69.2	77.0	77.9	45.5	49.3	29.4	50.9	41.6	44.8	56.9
Germany	83.4	89.5	88.5	73.0	55.0	40.5	47.4	55.3	65.2	53.3	68.5
Ghana	61.8	60.2	55.8	69.2	40.9	50.0	43.7	41.3	29.3	34.0	47.0
Greece	78.4	82.3	77.4	76.0	47.9	38.8	43.9	51.1	45.5	45.5	62.7
Guatemala	59.4	56.5	51.9	69.2	39.1	41.2	43.2	31.8	36.9	42.1	39.7
Guinea	54.9	46.4	50.0	66.9	38.6	46.6	44.7	38.4	26.1	40.4	35.2
Guyana	67.4	68.3	72.2	68.3	43.8	52.6	38.6	38.9	40.0	39.3	53.4
Haiti	52.6	43.1	46.5	66.6	34.3	34.3	49.5	26.7	28.6	36.2	30.1
Honduras	62.9	58.0	54.9	75.1	41.0	44.3	47.5	34.6	30.9	44.9	43.6
Hungary	79.4	83.6	77.5	80.2	49.4	42.2	42.0	52.1	48.5	54.1	57.4
Iceland	78.3	83.0	91.7	60.9	59.2	59.4	51.9	64.9	55.3	54.9	68.6
India	63.4	66.0	54.5	70.2	40.2	41.5	36.6	40.4	39.9	32.2	50.7
Indonesia	70.2	69.1	68.2	73.0	42.8	45.5	32.2	49.8	40.4	34.8	54.1
Iran	69.1	73.7	61.4	72.9	36.9	37.1	18.9	36.6	53.0	28.4	47.3
Iraq	64.8	51.8	66.6	68.0	32.6	33.1	21.5	34.3	26.9	39.7	39.9
Ireland	80.1	87.1	84.7	69.8	55.2	49.6	49.9	56.8	49.2	53.6	72.2
Israel	74.0	85.9	77.9	60.1	47.7	30.8	42.9	49.0	61.8	40.7	61.2

Country	SDG index score	Economic SDGs	Social SDGs	Environmental SDGs	Sustainable competitiveness	Natural capital	Resource Intensity	Social capital	Intellectual capital	Economic sustainability	Governance
Italy	78.8	85.7	76.5	75.3	52.3	45.4	45.2	58.9	57.4	46.3	60.6
Jamaica	69.6	71.4	66.9	70.8	40.6	40.2	42.3	36.6	36.2	35.4	53.0
Japan	79.4	90.3	80.4	69.3	55.3	42.8	42.1	63.6	68.6	49.0	65.2
Jordan	69.9	71.1	63.0	75.7	39.9	31.7	44.8	40.2	37.8	38.2	46.9
Kazakhstan	71.6	71.5	77.2	66.4	44.7	48.3	27.8	46.3	43.5	44.6	57.6
Kenya	60.9	54.8	58.6	68.3	41.7	34.4	48.2	39.9	35.3	46.3	45.8
Korea, Rep.	78.1	92.0	78.4	66.2	53.2	35.9	34.0	59.1	75.2	48.7	66.3
Kuwait	64.4	73.9	63.7	52.9	36.9	34.7	28.2	45.5	36.2	29.5	47.5
Kyrgyz Republic	74.4	66.9	77.2	80.4	43.6	49.7	29.8	50.3	41.5	43.8	46.8
Lao PDR	63.0	57.8	60.4	71.7	41.5	57.0	24.0	35.3	37.0	44.0	51.8
Latvia	80.7	82.0	78.5	81.7	56.1	58.9	50.7	54.5	52.8	51.3	68.5
Lebanon	67.5	71.4	62.0	69.8	32.5	27.2	25.8	41.4	28.3	32.2	40.0
Lesotho	54.9	36.6	56.2	69.2	39.2	43.0	45.1	34.0	30.4	39.6	43.0
Liberia	49.9	37.0	45.0	65.5	39.4	40.4	46.4	37.4	32.2	37.5	42.5
Lithuania	76.8	80.5	78.7	71.9	55.1	56.3	47.4	57.7	50.0	49.2	70.0
Luxembourg	77.6	85.9	88.3	58.9	53.6	40.8	57.2	55.1	48.9	48.2	71.7
Madagascar	50.3	33.1	49.3	65.5	38.3	44.7	45.5	34.3	25.7	34.7	44.9
Malawi	56.3	39.8	56.6	70.5	41.6	41.6	52.3	40.6	30.9	39.6	44.6
Malaysia	69.8	77.5	65.5	67.9	44.3	40.2	33.9	47.7	45.7	42.2	56.1
Maldives	71.3	70.3	73.8	69.5	44.1	33.7	40.7	54.6	37.2	43.3	54.9
Mali	58.0	47.6	50.8	75.3	34.3	40.8	40.2	31.1	24.7	35.2	33.8
Malta	75.5	83.2	76.3	68.4	49.6	36.6	48.6	53.8	50.6	42.9	65.1
Mauritania	57.2	49.5	53.2	67.7	36.4	39.0	37.0	36.8	25.8	34.8	44.8
Mauritius	68.0	74.2	66.8	63.9	42.6	38.0	30.3	47.7	42.9	43.1	53.7
Mexico	69.7	70.7	67.6	71.0	41.1	43.3	33.4	37.0	42.1	43.5	47.7
Moldova	78.6	70.9	84.8	81.7	45.8	44.0	31.0	57.0	37.0	41.4	64.6
Mongolia	64.7	63.6	70.7	59.4	44.3	46.0	30.4	48.7	42.0	39.7	58.9
Montenegro	71.4	69.9	75.1	69.0	46.2	46.1	44.2	53.0	36.1	39.9	58.0
Morocco	70.9	70.5	64.2	77.9	40.4	39.4	36.9	34.1	44.3	39.1	48.4
Mozambique	52.7	34.0	50.7	70.3	37.8	47.6	38.6	33.9	32.8	36.0	37.7
Namibia	64.3	52.7	63.8	74.4	40.8	40.9	45.6	36.7	33.8	39.3	48.2
Nepal	66.5	63.1	61.9	76.5	44.4	45.0	38.5	45.3	41.6	40.9	54.9
Netherlands	79.4	88.5	87.4	63.9	54.1	38.8	48.6	60.9	59.9	45.2	71.3
New Zealand	78.4	82.4	85.7	65.2	51.9	47.5	42.7	52.4	49.7	48.7	70.1
Nicaragua	64.8	59.8	61.0	72.7	41.6	53.4	40.6	37.9	31.9	46.0	40.0
Niger	48.3	34.9	42.8	64.7	35.7	44.2	43.1	34.7	21.7	30.1	40.0
Nigeria	54.3	50.9	42.1	69.2	37.6	40.9	48.4	36.1	25.4	37.1	37.5
North Macedonia	72.5	70.5	69.9	79.0	45.3	41.7	30.8	60.8	33.5	46.2	59.0

Country	SDG index score	Economic SDGs	Social SDGs	Environmental SDGs	Sustainable competitiveness	Natural capital	Resource Intensity	Social capital	Intellectual capital	Economic sustainability	Governance
Norway	82.0	87.1	94.5	65.2	57.7	53.3	48.8	63.5	60.4	47.3	73.0
Oman	68.6	72.4	69.4	60.9	38.2	40.1	22.8	43.3	42.9	33.4	46.8
Pakistan	59.0	52.2	53.7	69.9	34.4	33.2	32.7	34.9	27.8	39.1	38.8
Panama	67.3	68.3	62.5	71.3	46.6	53.4	48.0	39.8	35.3	48.6	54.7
Papua New Guinea	53.6	38.9	51.6	67.9	41.1	50.6	59.6	33.1	25.7	38.1	39.7
Paraguay	68.8	70.8	60.9	77.1	48.4	59.8	44.5	41.1	41.8	47.6	55.7
Peru	71.7	71.5	65.5	77.9	47.0	56.2	37.4	47.3	47.7	41.8	51.7
Philippines	67.1	64.2	61.6	75.1	42.3	40.8	38.4	43.9	42.9	39.5	48.4
Poland	81.8	83.8	83.6	78.3	51.6	49.2	41.5	55.3	51.9	48.8	62.8
Portugal	80.0	83.9	83.7	73.1	55.5	50.3	49.8	59.9	58.8	50.1	63.9
Qatar	66.2	78.1	65.4	53.8	39.7	33.1	32.0	50.0	42.4	33.1	47.7
Romania	77.5	80.9	71.2	80.9	49.4	53.6	45.2	51.9	35.0	49.3	61.4
Russian Federation	73.8	79.1	74.9	68.3	47.0	58.3	29.2	43.1	53.3	46.3	52.0
Rwanda	60.2	48.9	59.9	70.5	42.2	43.7	46.8	37.1	39.2	41.9	44.7
Sao Tome and Principe	62.7	50.2	61.7	74.3	43.6	32.3	48.9	44.3	39.8	42.8	53.7
Saudi Arabia	67.7	77.9	68.6	56.9	39.8	42.7	25.8	44.1	43.6	31.1	51.7
Senegal	61.8	60.6	52.5	72.2	41.0	40.1	36.5	47.8	37.2	37.2	47.4
Serbia	77.3	82.4	76.1	76.2	46.3	54.6	25.5	52.7	41.0	46.0	57.9
Sierra Leone	55.7	44.8	52.9	67.5	41.8	52.9	54.9	38.6	31.0	38.6	34.6
Singapore	71.8	84.2	80.4	54.8	49.4	29.0	34.6	53.0	68.9	46.3	64.8
Slovak Republic	79.1	82.9	79.4	77.6	51.9	51.4	43.2	56.5	46.0	52.8	61.4
Slovenia	81.0	84.8	84.5	74.3	55.7	44.2	44.9	63.7	55.0	56.5	69.7
Somalia	48.0	23.5	51.4	65.0	32.1	25.7	46.0	26.1	22.8	34.0	37.7
South Africa	64.0	61.2	60.7	69.6	39.6	43.1	34.5	32.4	43.5	32.8	51.4
South Sudan	38.7	19.2	29.6	63.5	33.1	48.8	39.1	23.8	22.5	32.7	31.7
Spain	80.4	85.6	83.3	73.3	50.8	43.6	48.5	57.8	46.5	43.1	65.5
Sri Lanka	69.4	73.5	64.2	71.3	42.0	38.7	40.4	48.4	36.7	40.0	47.6
Sudan	48.6	33.2	44.1	65.8	32.7	42.4	34.2	30.0	25.9	27.4	36.4
Suriname	68.2	57.9	69.3	77.7	41.1	49.4	26.7	35.4	34.9	48.3	51.8
Sweden	86.0	88.3	91.8	78.2	59.6	53.8	58.0	62.4	60.7	50.6	72.2
Switzerland	80.5	88.4	83.6	71.9	59.1	51.3	55.7	57.4	63.6	52.7	74.0
Syrian Arab Republic	58.2	46.6	49.4	69.9	33.9	40.4	33.6	33.0	35.4	27.2	33.5
Tajikistan	69.2	61.6	67.5	79.6	39.9	47.7	27.0	42.8	36.1	37.0	48.5
Tanzania	56.8	46.7	53.8	68.3	41.4	51.1	46.2	41.9	28.5	36.5	44.1
Thailand	74.7	76.3	75.6	72.6	43.6	38.6	30.7	49.2	55.1	38.2	49.4
Togo	56.3	46.4	50.4	70.3	39.8	43.0	45.8	33.6	34.7	39.1	42.6

Country	SDG index score	Economic SDGs	Social SDGs	Environmental SDGs	Sustainable competitiveness	Natural capital	Resource Intensity	Social capital	Intellectual capital	Economic sustainability	Governance
Trinidad and Tobago	63.0	69.9	70.3	56.0	38.9	32.2	39.8	43.7	32.1	33.1	52.6
Tunisia	72.5	71.4	71.3	74.7	37.9	31.7	32.4	42.1	40.5	35.0	45.4
Türkiye	70.8	77.9	64.5	71.1	45.3	45.9	26.8	39.4	58.6	49.9	51.0
Turkmenistan	68.5	62.6	76.2	64.0	38.5	41.5	28.5	39.6	39.7	30.3	51.4
Uganda	55.0	48.2	47.1	69.1	39.7	45.6	47.0	37.2	24.4	40.0	44.2
Ukraine	76.5	67.9	79.9	76.3	46.2	51.0	42.8	50.4	41.2	43.6	48.0
United Arab Emirates	69.7	80.5	77.6	52.9	43.2	34.3	26.1	57.0	43.1	39.7	59.3
United Kingdom	81.7	87.2	81.0	77.6	54.8	45.9	58.0	53.8	65.2	46.2	59.9
United States	75.9	87.2	76.5	65.9	50.9	50.6	42.6	42.5	64.6	49.9	55.2
Uruguay	77.7	79.0	78.5	75.9	50.9	62.4	40.7	47.0	44.7	45.0	65.6
Uzbekistan	71.1	63.9	75.3	74.5	42.4	44.5	26.0	52.2	38.2	34.6	59.0
Venezuela, RB	62.9	49.3	55.6	81.5	40.7	55.7	44.9	37.6	31.2	38.6	36.4
Vietnam	73.3	75.0	75.6	69.7	46.3	45.6	35.5	42.0	49.0	46.4	59.2
Yemen, Rep.	46.8	29.1	43.3	65.2	34.0	33.7	54.8	29.7	29.9	29.9	26.2
Zambia	54.3	40.1	49.6	71.8	39.1	50.2	36.4	32.4	30.3	39.9	45.2
Zimbabwe	55.6	40.4	52.9	71.9	38.2	49.0	44.6	30.0	26.4	36.0	43.2

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