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The sustainable security index: a new measure for research and policy analysis

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ABSTRACT

This article introduces the Sustainable Security Index (SSI), a new measuring tool with the potential to advance research and policy analysis in international security by looking beyond militarised security solutions. The proposed index integrates the multi-dimensional concept of security and sustainability with weighted drivers of instability. Using the index, we rank 168 countries in terms of their contribution to global peace and stability in 2021, with particular attention to their environmental, political and economic governance. The majority of the top ranked countries are in Europe and North America while the lowest scoring countries are in Asia and Africa, highlighting the need to consider regional and global north-south divides. The SSI can encourage discussion about which type and level of intervention may benefit international stability. The Index can also forecast security risks around the world and thus contribute to creating watch lists of countries and regions of concern.

KEYWORDS

Sustainable; security; peace; environment; development

Introduction

We need a surge in diplomacy for peace, a surge in political will for peace and a surge in investment for peace. UN Secretary-General António Guterres, SG/SM/21146 (2022)

The Sustainable Security Index (SSI) is a new measure of security designed to advance research and encourage collaboration in academia and beyond by looking past military security solutions. It evaluates and compares countries' contributions to global peace and stability, with particular attention to environmental, political and economic governance. The relationship of economic, political and environmental governance with security and sustainability is complex, interlinking, and multidimensional. The SSI acknowledges this complexity and represents the first integrated approach to bridge sustainability and security and a first step towards building a sophisticated measure of instability. The new design improves on prior work by the Oxford Research Group (ORG), a London-based research institution working on peace and security issues, and features a weighted index.

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This article focuses on the design and aims of the SSI with a view to stimulating discussion on the theoretical and practical issues of measuring sustainable security. Following a brief discussion of the literature, the second section of the paper explains the design considerations and the key dimensions of the SSI. The third section begins to apply the proposed index by discussing data selection and strength and limitations of the methodology and data. The fourth section uses the SSI to measure 168 states' impact on global security in 2021. The article concludes with a consideration of some of the main issues for future research.

Background

There is an ongoing critical debate about how to conceptualise security in international relations. Security is an 'essentially contested concept' because it is an ever-changing product of history and political context.¹ Traditionally, security was defined with a focus on states' military power to preserve their territorial integrity and physically protect their citizens.² However, after the end of the Cold War and following 9/11, the conception of security expanded beyond militarism to include other sectors, including political, economic, social and environmental arenas, especially as technology, information exchange, capital flows and transportation developed.³ As a result, 'conventional military power has lost its role as an indicator of one state's power'.⁴

Today's increasingly complex security challenges, including pandemics, forced migration, climate change, and the role and direction of international institutions (e.g. NATO, UN), have led to a broadening of the multi-disciplinary concept of security to include the realm of sustainability. 'The concept of sustainability – defined by the 1987 United Nations Brundtland Commission as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" – is relatively well-established, whereas the definition of "sustainable security" is less clear and requires further exploration'.⁵

The emerging concept of sustainable security has been a topic of discussion in an array of disciplines, from international relations and economics to medicine and sports. While this expansion provides a plethora of avenues for research, it highlights the challenge of organising many dimensions of sustainable security under one umbrella. It is widely accepted, however, that sustainable security 'integrates and subsumes' human security, environmental security, defence and diplomacy.⁶ This contemporary security paradigm has inspired research on 'resilience-oriented thinking' with 'complex adaptive systems', with a focus on human security instead of traditional national security. This new thinking includes initiatives by the Stockholm Resilience Centre (SRC) and the ORG to create models integrating dimensions of sustainable security in a practical manner,⁷ and efforts by the Policy Coherence for Sustainable Development (PCSD) to link security and development challenges.⁸ It also led to the development of the SSI.

On a global scale, the logical conceptual link between development and security was recognised in 2015 in the establishment of the UN Sustainable Development Goals (SDGs), following decades of effort. SDG 16, to 'promote peaceful and inclusive societies for sustainable development', was particularly important, as it integrated peace into sustainable development and into the UN policy framework for the first time. UN Office for the Coordination of Humanitarian Affairs (UCHA) identifies seven major

security dimensions that go beyond military power and engagement: economic, food, health, environmental, personal, political and community dimensions.

A growing literature focuses on the various dimensions of sustainable security.⁹ Much of the work is dedicated to analysing one particular dimension or to comparing dimensions. Beyond the traditional political and defence dimensions, these include economic,¹⁰ environmental,¹¹ food¹² and human¹³ dimensions.

Previous conceptualisation of the SSI included the same weight for each indicator, however, by engaging international security experts to determine the relative importance of each indicator, here, we aim to reflect the complex and multifaceted nature of international security more accurately and provide more meaningful and policy-relevant insights.¹⁴

There have also been other notable efforts to provide various perspectives on security, incorporating elements of peace, stability, governance, human development, environmental sustainability, terrorism and food insecurity prior to the SSI. Comparable indices notably include Global Peace Index (GPI), World Governance Indicators (WGI) and Human Security Index (HSI), however, the SSI particularly differs in terms of purpose, focus and indicators. Below is a comparison table of these indices summarising these points (Table 1):

The SSI's combination of sustainability and security, its comprehensive and multi-dimensional indicators, and its focus on preventative and proactive strategies distinguish it from other indices that measure peace, governance, or human security. Thus, the SSI was born from the need to create a measure to combine the many dimensions and numerous indicators of sustainable security. To the best of our knowledge, the SSI is the first index that consists of the main drivers of the various types of insecurity with weighted variables. As such, it creates a picture of where each country in the world stands in terms of its contribution to sustainable security.

When we discuss a country's 'contribution' to global security, we are considering how its actions, both positive and negative, affect sustainable security. The SSI takes this into account by looking at how a country's actions – whether they help maintain peace or potentially lead to instability – affect the international security environment.

Table 1. Comparison of similar indices.

Index	Purpose	Focus
Sustainable Security Index (SSI)	To evaluate and compare countries' contributions to global peace and stability, focusing on environmental, political, and economic governance.	Interlinks multidimensional nature of security and sustainability. Focuses on long-term, proactive solutions unlike indices that primarily assess current states of peace or governance.
Global Peace Index (GPI)	To measure the relative position of nations' and regions' peacefulness. It focuses on the absence of violence and fear of violence.	Primarily focuses on violence and fear of violence, with a narrower scope on security compared to SSI's broader sustainability focus.
World Governance Indicators (WGI)	To measure the quality of governance across countries, with a focus on: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and control of corruption.	Focuses exclusively on governance quality without integrating environmental and sustainability dimensions.
Human Security Index (HSI)	To assess the level of human security in countries, emphasising economic, environmental, and social dimensions.	Emphasizes human security and social dimensions but lacks specific focus on political governance and proactive security strategies.

Importantly, the SSI recognises that countries are not necessarily responsible for challenges brought on by external threats. For instance, when a country increases military spending in response to external aggression, the SSI considers how it might escalate tensions, rather than simply labelling it as a destabilising factor. However, the SSI also considers the broader effects of these actions on international instability. An example is Ukraine's significant increase in military expenditure: while Ukraine's military build-up in response to Russian aggression was anticipated, the SSI's role is to quantify and compare such responses, helping to identify trends and shifts in global security dynamics.

Designing the SSI

The SSI is intended to be an annual index that incorporates key drivers of instability in areas of socioeconomic, political and environmental governance. Measuring a multidimensional phenomenon is bound to be controversial, as any attempt at using a select number of quantified indicators to express a highly complex issue, such as the integration of sustainability and security, will trigger debate. We recognise the complex methodological challenges, particularly in terms of selection and weight of indicators, and the aim of this paper is not to put an end to the debate and resolve the challenges of an integrated measure or of international instability, for that matter, but to encourage more discussion and further research.

The proposed index does not aim to assess states' individual fulfilment of each dimension or indicator but to make meaningful comparisons across countries. For this purpose, the indicators were chosen to 'prioritize the resolution of the interconnected underlying drivers of insecurity and conflict, with an emphasis on preventative rather than reactive strategies',¹⁵ based on the argument that sustainability can be achieved if we focus on resolving the 'underlying drivers' rather than the consequences of insecurity.¹⁶

The goals for the index were the following: it should cover as many dimensions of sustainable security as possible; it should enable cross-national comparisons to determine whether a country has performed better or worse than others in sustainable security over time; it should cover a large number of countries and all regions; it should be simple to calculate, access, update and replicate without requiring econometric expertise; finally, it should be relevant for use in evidence-based policy research, initiate discussion in political circles and raise public interest. To do so, it is crucial to consider the interplay between various factors including economic, political and environmental governance. For instance, robust governance frameworks can facilitate effective disaster response and adaptation strategies, mitigating the impacts of climate change. Conversely, poor governance can lead to inadequate responses, increasing vulnerabilities and security threats.

To test our proposed index, we selected a limited number of indicators and used existing publicly available global data sets to measure their application across countries. In the following subsections, we explain the rationale for the selection of each and give the source.

Political and economic governance

Political freedom, military expenditure, government use of force and ongoing conflict are indicators that measure how governance impacts both internal stability and international

relations.¹⁷ These indicators provide a comprehensive view of a country's governance quality and its approach to maintaining peace.

Economic stability underpins other security dimensions: foreign direct investment (FDI) and economic freedom are crucial indicators of a country's economic health and its integration into the global economy, which can mitigate conflict and enhance security.¹⁸

Foreign direct investment

As defined by OECD, foreign direct investment (FDI) 'is a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy'.¹⁹ It can play a significant role in sustainable economic development²⁰ and is linked with economic growth in both the short and the long run, particularly in developing countries.²¹ Although the extent of the impact differs with the level of development and circumstances of the political and economic governance of countries, evidence shows 'FDI links between countries are more likely to reduce conflict than trading links'.²² Importantly, there is a negative correlation between FDI flows and armed conflict.²³ To measure the FDI indicator, the SSI uses FDI data from the World Bank, based on International Monetary Fund (IMF) balance of payments.²⁴

Political freedom

Political freedom, defined as 'the absence of coercion by others and by the government',²⁵ is an indispensable component of sustainable security. It is usually discussed under the human security dimension, as it relates to 'the protections of an individual's personal safety and freedom from direct and indirect threats of violence'.²⁶ As we are defining sustainable security beyond national and territorial security, our paper challenges Posner and Vermeule's argument that one must come at the cost of the other.²⁷ As Daemen suggests, freedom can support sustainable security in a democratic society.²⁸ The political freedom indicator we use is from Freedom House, as the organisation conceptualises and measures freedom by including both political and civil liberties in its rating for each country.²⁹ Political freedom measures the quality of governance and individual freedoms, setting it apart from economic or military measures. Although it relates to government use of force, it remains distinct in measuring civil and political liberties; whereas civil liberties measure freedom of speech and press, political liberties assess electoral process, judicial independence and enforcement of laws.

Military expenditure

Military spending in relation to GDP or government spending is the most significant indicator of the level of militarisation. The number of military personnel is no longer an adequate measure of militarisation in today's world because of technological advancements in weaponry and unmanned military devices such as drones.³⁰ However, absolute increases or decreases in military budget can mean a state is contributing to security or instability.³¹ The SSI attempts to overcome this dilemma by calculating the change in military expenditures as percentage of government spending over the last decade using the Stockholm International Peace Research Institute (SIPRI) Military Expenditures

Database. While related to government use of force, military expenditure specifically quantifies financial metrics, not the practical deployment of force.

Government use of force

How a government responds to security threats such as terrorism, uprisings and organised crime and whether there is civilian control over its military and security forces have repercussions beyond a state's borders. While use of force is no longer the only defining component of security, its analysis is an important tool to produce 'meaningful early warning and effective policy responses'.³² Use of force also provides an opportunity to compare states that tend to lean on military responses to instability versus states that try to use soft power international cooperation. We use the Fragile States Index (FSI) security apparatus to measure government use of force. Government use of force focuses on practical applications and civilian oversight, distinct from the financial aspects measured by military expenditure.

Ongoing conflict

Maintaining peace is a key component of sustainable security, as it 'reduces the risk of lapse of relapse into violent conflict'.³³ A country's involvement in internal and external conflicts is a major driver of instability and may have consequences beyond the immediate effects of deaths and injuries, including disruptions to economic systems with fundamental changes to food supply and security. A good example is the conflict between Russia and Ukraine. Our indicator of ongoing conflict comes from the Global Peace Index (GPI), an index measuring level of peace using quantified indicators. Ongoing conflict offers a broader picture of conflict impact beyond government actions alone.

Refugee generation

Parallel to the expanding conceptualisation of security, there has been a shift in the perception of refugees. Instead of being viewed as part of the legal asylum process, they are increasingly seen in the context of human security.³⁴ Although countries often consider forced migration a threat to their national security and territorial integrity, displacement occurs for a number of complex reasons beyond armed conflicts, such as climate change, and is a key indicator of instability.³⁵ The SSI views refugees as a long-term challenge to sustainable security because large-scale displacements can potentially lead to social and political tensions in receiving areas by straining resources if not mitigated properly. Therefore, addressing the root causes and ensuring effective management of refugee movements is crucial for maintaining sustainable security.³⁶ The refugee data for the SSI (percentage of the population in the country of origin) are taken from the United Nations High Commissioner for Refugees (UNHCR) Refugee Population Statistics. While influenced by conflicts and environmental factors, it uniquely focuses on displacement and refugee dynamics.

Environmental governance

Environmental factors are fundamental to global stability. Issues like climate change, carbon emissions, and ecological threats directly impact food and water security, health,

and migration patterns, which in turn influence political and economic stability.³⁷ The inclusion of CO₂ exports and ecological threats captures critical aspects of environmental governance that affect both present and future security.

Carbon dioxide (CO₂) exports

Carbon emissions continue to be a much-debated aspect of climate change and environmental security. The nexus between green investment, economic growth, energy consumption, emission reduction and environmental security is difficult to determine, particularly as there are issues of obtaining transparent and detailed data at the domestic level in some developing countries. Therefore, the SSI focuses on CO₂ emissions embedded in trade as an indicator of environmental governance, using data from the Global Carbon Atlas of the Global Carbon Project. We use this measure because it is well known that CO₂ warms the planet, contributing to climate change, and evidence shows direct links between climate change and food security. This may spill over to the other dimensions of security and development, albeit indirectly; for example, it may lead to an increase in conflicts.³⁸

Ecological threats

Environmental governance and security face numerous challenges, including food security, water scarcity, high population growth and natural disasters such as floods and cyclones, some of which may be related to climate change. Countries' ability to identify hot spots of ecological challenges allows them to assess their resilience to shocks and the effects of disruptions to social, economic and political systems, such as mass population displacements due to instability and conflict.³⁹ There is a positive association between the world's least peaceful countries and food insecurity, and water scarcity is projected to cause conflict in the coming decades.⁴⁰ The Ecological Threat Register (ETR) assigns a score to each country based on the overall number of ecological threats it faces. We use this score as the ecological threat indicator. The ETR encompasses a broader range of environmental threats than *CO₂ exports*.

Sustainable development goals (SDGs) score

SDG16 stresses the link between sustainability and peace, but the remaining Goals also relate to various dimensions of sustainable security, including human, economic, environmental, energy, food and water security (SDG, 2022) making states' progress in their achievement of the SDGs a key indicator for the SSI. Other goals, such as SDG1 (No Poverty), SDG2 (Zero Hunger), SDG3 (Good Health and Well-being), SDG6 (Clean Water and Sanitation), SDG7 (Affordable and Clean Energy), and SDG13 (Climate Action), also support security by addressing underlying drivers of conflict and instability, such as poverty, resource scarcity, and health crises. Although SDG16 makes the strongest statement, the SDGs are integrated and interlinked, making an overall consideration of SDGs necessary as an indicator of sustainable security. The global pandemic may have 'exposed the fragility of the goals', but the targets remain for 2030, and the SSI focuses on the progress of states, not on the resilience of the SDGs to shocks such as Covid-19.⁴¹ The interconnected nature of the SDGs mirrors our approach in the SSI, which seeks to integrate various dimensions of security and sustainability into a cohesive framework (Figure 1).

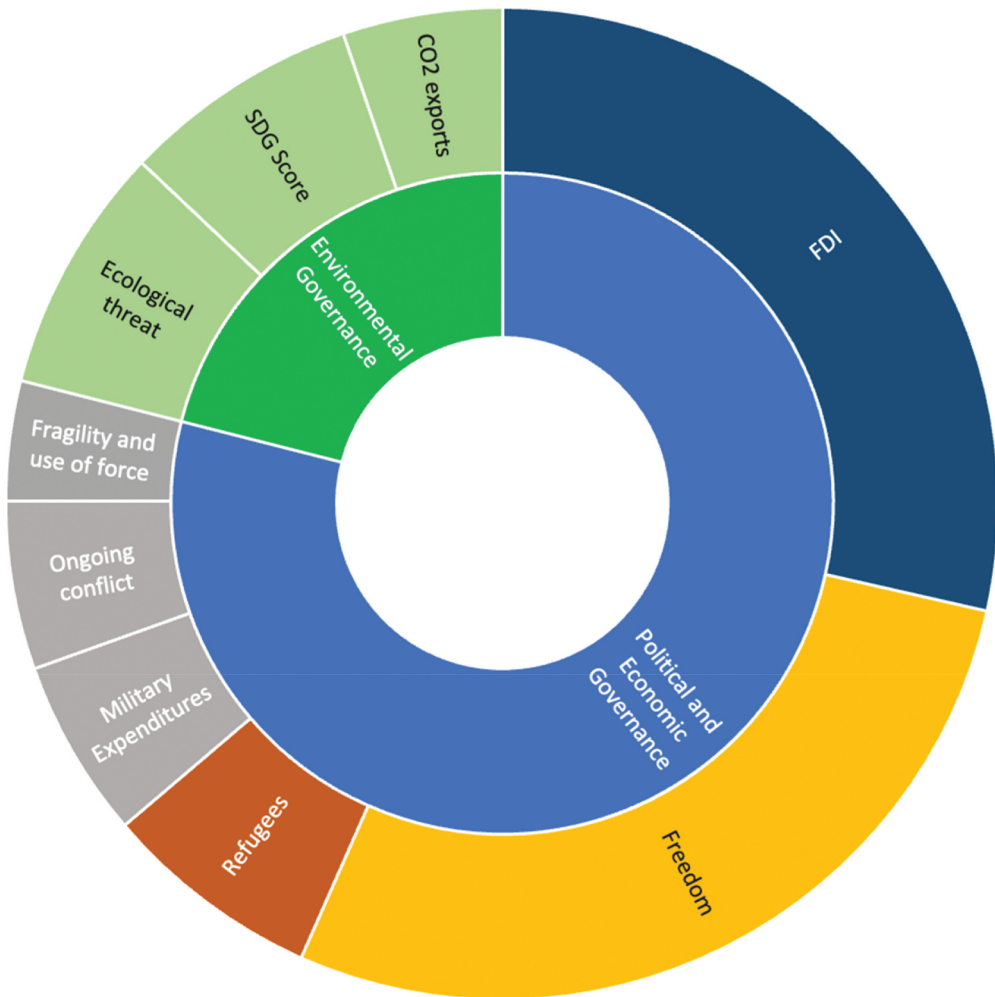


Figure 1. Construction of the SSI.

Methodology

There is no standardised way to measure sustainable security, although several exemplary established indices propt to measure peace, conflict, development and sustainability. These include the Human Development Index,⁴² Global Peace Index⁴³ and the armed conflict data sets produced by the Uppsala Conflict Data Program.⁴⁴ Before the SSI was developed, the closest formulation of a relevant index was the Sustainable Livelihood Security Index (SLSI) which attempted to ‘reflect the ecology-economic-equity interface of sustainable development’.⁴⁵

Constructing an index to measure security is difficult because it is not possible to ‘physically observe the aspect we are trying to measure’.⁴⁶ Quantifying multiple dimensions is particularly challenging for capturing the context-specific factors and the chosen indicators may not fully encapsulate the complex and interconnected realities on the ground. Böhringer and Jochem point to the particular challenges of ‘measuring the

immeasurable' when building indices for sustainability; they mention the lack of general rules of normalisation, thematic problems with aggregation and commensurability of input variables.⁴⁷ Moreover, when it was being developed, it was not possible to test the SSI for validity, as there were no comparable indices. Therefore, an advisory board examined the SSI for face, construct and content validity in all stages of the research in terms of selection of the variables and weight assigned to each indicator.⁴⁸ The indicators were each assigned a weight based on a survey of experts. It is important to note that whilst the choice of indicators and weighting is based on expert judgement, these choices are not neutral since it involves subjective decisions about the relative importance of each factor and dimension. This subjectivity, inherent in any construction of a similar index, can potentially lead to interpretations that emphasise certain aspect of security over others and should be regularly reviewed to minimise bias.

As discussed previously, the indicators fell within the areas of environmental, economic and political governance. Some were taken from existing data sets, including *fragility and use of force* from the FSI, *ongoing conflict* from the GPI, *freedom* from Freedom House, *military expenditures* from the SPRI, *ecological threat* from the ETR and *SDG scores* from the UN. *Refugees* were calculated as percentage of the population in each country. Original data for *FDI* and *CO₂ exports* came from the World Bank and Global Carbon Project, respectively.

Using these measures, we created an index for 2021 that includes 168 countries with populations of 500,000 or more, representing nearly 99 per cent of the world's total population.⁴⁹ Each indicator was first normalised and then assigned a weight; the country rating was computed by adding all the weighted indicator scores. If a value was missing in an indicator of a state, that indicator was omitted from the sustainable security rating calculation for that state rather than estimating an average value to avoid bias. [Appendix](#) lists the states by their 2021 sustainable security score and highlights states with missing data.

The SSI consists of quantified data from nine indicators. Some of the indicators consist of existing indices including *fragility and use of force* from the FGI, *ongoing conflict* from the GPI, *Freedom* from Freedom House, *Military Expenditures* from the SPRI, *Ecological Threat* from the ETR and *SDG scores* from the UN's SDG. *Refugees* were calculated as percentage of the population in each country. Original data for the *FDI* and *CO₂ exports* were directly used from the World Bank and Global Carbon Project respectively.

For normalisation, we rescaled the original values to the interval 0 to 100, with 100 the best possible score of achievement.⁵⁰ Minimum and maximum values were computed for each indicator and used in the following formula in each indicator's data set:

$$\text{Normalized value} = \frac{\text{actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$$

To allow a meaningful comparison, *FDI net inflows* and *CO₂ exports* were converted to percentiles before the normalised values were computed. The remaining indicators already had values between 0 and 100, with the exception of *military expenditures* and *ecological threat*. *Ecological threat* was rescaled from 0 to 100. As absolute *military expenditures* of a country in a year does not indicate whether it is contributing to security

Table 2. Weights for the SSI.

Dimension	Indicator	weight multiplier
Environmental Governance	Ongoing conflict	1.32
	Fragility and use of force	1.26
	Military expenditures	0.64
	Freedom	0.94
	Refugees	1.04
	FDI	0.53
Political and Economic Governance	Ecological threat	1.19
	CO2 exports	0.34
	SDG score	0.72

or instability, we computed the change in *military expenditures* as percentage of GDP and compared it to the values a decade earlier. This meant that a country with a significant increase in its military expenditures as percentage of its GDP scored lower than countries that decreased their military expenditures (as percentage of their GDP).⁵¹

Once normalisation of original data was complete, weights were assigned to each indicator based on a survey of experts who joined the study on a voluntary basis. The experts who participated in the survey were selected based on their qualifications in International Relations, with a minimum of a Master's degree, to ensure a solid understanding of global security issues. They were chosen from both academic and professional backgrounds to provide a diverse range of perspectives. The process of assigning weights to each indicator was conducted through a structured online survey using Qualtrics. The survey was completed online, privately and individually. Participants were asked to evaluate the relative importance of each indicator in contributing to sustainable security by giving scores to the nine indicators. An adjusted weight multiplier was computed by taking the average score for each indicator based on the participants' responses. The survey results showed a reasonable degree of consensus among participants and weighting decisions were informed by the average scores from all respondents, ensuring that no single viewpoint disproportionately influenced the final weights. This approach aimed to balance practicality with expert judgement (Table 2).

Results

Figure 2 shows the SSI findings for 2021, and Figure 3 lists the top 10 and bottom 10 countries. In brief, the majority of the top 10 ranked countries are in Europe and North America, with the exception of New Zealand and Japan, and the bottom 10 are in Asia and Africa. This highlights the need to look beyond national borders and consider regional and global north-south divides. At first glance, the high scores of the top performing countries may seem to indicate their success in contributing to global security, but a closer look suggests the low scoring countries, including Afghanistan, Kosovo, Libya and Iraq, point to the failure of Western efforts to bring stability to countries locked in prolonged conflict. This finding also raises questions about the appropriateness of the type and level of intervention, particularly as most Western aid focuses on donating or selling armaments and providing military training. Interestingly, none of the countries in the top 10 possesses nuclear weapons, thus supporting the need

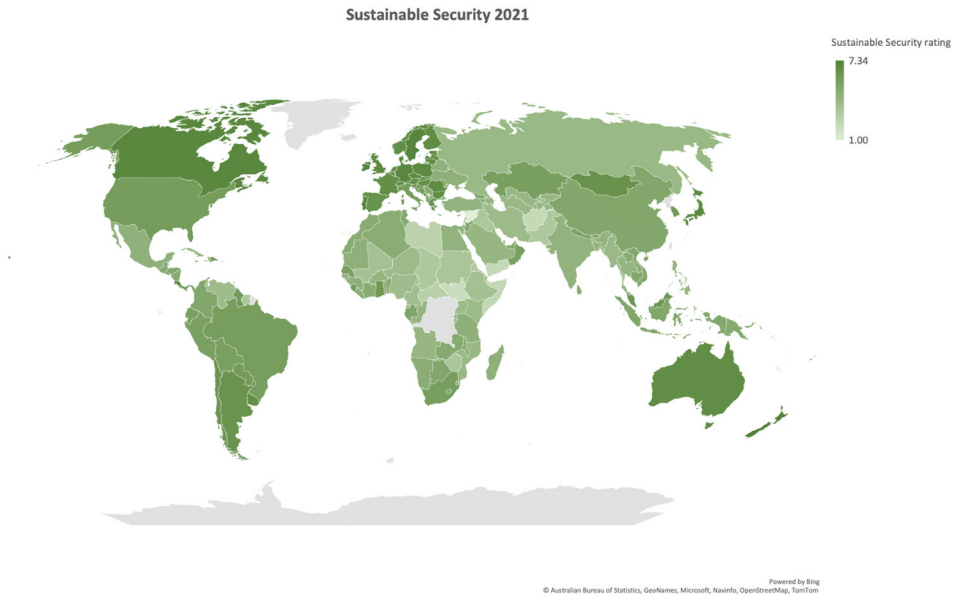


Figure 2. Sustainable security ma.

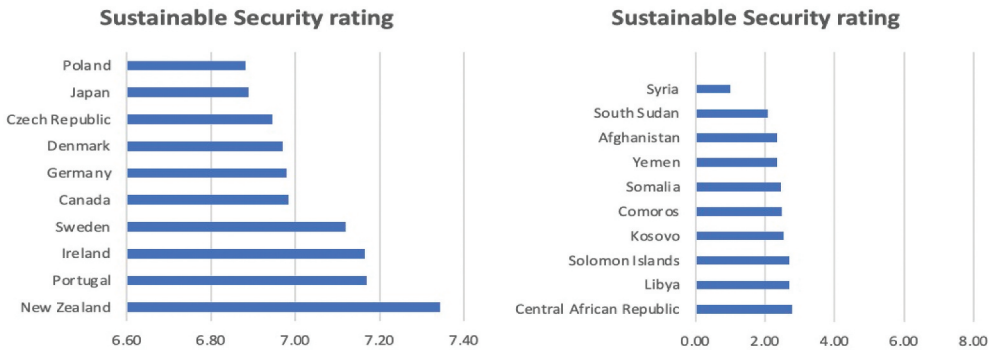


Figure 3. Sustainable security ratings of the top and bottom 10 states.

to look beyond military strength to find long-term solutions for instability. Even so, militarisation is still one of the main indicators of instability. Notably, Ukraine numbered amongst the countries with the highest increase in military expenditures as percentage of GDP during 2011–2021. Thus, there was reason for alarm even before the escalation of war with Russia in 2022. The case of Ukraine may be more widely known, but the SSI can forecast similar security risks around the world and thus contribute to creating watch lists of countries and regions of concern.

Looking at the results for political indicators amongst countries at the bottom, we see Afghanistan, Central African Republic, Somalia, South Sudan and Syria generate a significant number of refugees as a proportion of the total population. In comparison, Germany and Sweden are major refugee recipient countries, but they have high sustainable security ratings overall, underlining the need to focus on root causes of forced

displacement and to shift more resources to the refugee-generating countries. Unsurprisingly, low scores in freedom of speech and political liberties and a tendency to host or participate in armed conflict dominate the bottom 10 countries, including Syria, Afghanistan and Kosovo, in a stark contrast to the top 10 countries.

The overall picture is relatively mixed in terms of environmental governance, as countries in the bottom 10 have varying, low to mid scores for ecological threats and SDG scores. Chad, Eritrea, Guinea-Bissau, Solomon Islands, South Sudan and Timor-Lest have the lowest SDG scores; these are amongst the poorest countries in the world, and they struggle with climate change costs and high debts. They clearly need more development assistance and financing, but such aid is declining according to the UN.⁵² In comparison, the scores for the top 10 countries show they have the least threatening ecological issues and perform significantly better in their efforts to reach the SDGs. The findings for CO₂ exports are more problematic. The results suggest Canada and Poland should focus on this indicator, even though their overall sustainable security rating is high because they perform better on the rest of the drivers of security.

Implications

The SSI's inclusion of environmental, political, and socio-economic factors shifts from traditional security paradigms thereby holding significant theoretical implications across various academic and policy-related fields. Theoretical frameworks in security studies increasingly recognise that security extends beyond military capabilities to encompass sustainable livelihoods and stable societies.⁵³ The SSI supports this broader view by operationalising an expansive security concept that includes sustainable security along with advocating for addressing root causes of insecurity, such as environmental threats and state fragility, rather than just focusing on immediate threats.⁵⁴ This shift is crucial for developing long-term security policies that prevent conflicts and crises, aligning with theories that propose a proactive security strategy.⁵⁵

The SSI also aligns with human security theories that emphasise individual well-being as fundamental component of national security while measuring sustainable security at the state level.⁵⁶ This poses a challenge for operationalisation since the broad scope of human security can make it difficult to prioritise and measure specific aspects effectively.⁵⁷ There is also the risk of an excessive focus on human security which might undermine traditional state security concerns. However, the SSI balances the two by integrating human security into national security strategies, ensuring that the protection of individuals complements rather than conflicts with state sovereignty and stability.⁵⁸

The SSI also helps identify regional security trends and global shifts, contributing to the theoretical understanding of how different regions address security and sustainability challenges.⁵⁹ This adds a layer of empirical evidence to theories discussing regional security complexes and global security governance. Additionally, its adaptability to predict potential security risks as an early warning tool supports theories of dynamic systems and complex adaptive systems, emphasising the need for flexible and responsive tools in managing security and sustainability challenges in the dynamic international environment.⁶⁰

Additionally, its adaptability to predict potential security risks as an early warning tool supports theories of dynamic systems and complex adaptive systems. This emphasises the need for flexible and responsive tools in managing security and sustainability challenges in

the ever-changing international environment. The SSI's continued relevance in its ability to predict depends on this balanced approach between consistency and adaptability to reflect changes in the global security landscape. Hence, maintaining a consistent methodology over time makes it possible to track trends at the national, regional and global level allowing for meaningful longitudinal comparisons. In practice, this means that the core structure of the index should remain stable to ensure that changes in scores reflect real-world developments rather than shifts in data interpretation or weighting. However, the index also needs to be adaptable to incorporate new knowledge, emerging technologies and developments or changes in the understanding of the concepts they measure.⁶¹ To address this, the SSI will undergo an annual review process where the existing data will be updated, and the performance of the indicators will be assessed. Regular transparent reviews involving consultations with experts and stakeholders are integral to reflect new insights from security studies and related disciplines and maintain the relevance and accuracy of the SSI.⁶²

Conclusion

Sustainable security broadens the traditional understanding of security beyond military power and external threats. In its core, sustainable security requires a shift from reactive, short-term strategies to proactive, long-term solutions based on the interconnection between its political, economic and environmental dimensions. The SSI represents an attempt to create a simple and transparent global picture of quantified indicators of sustainable security. We discussed its construction and illustrated its efficacy by applying it to more than 99 per cent of the world's population using data from 2021. By constructing an index that measures countries' contribution to stability, we have taken the first step towards integrating the multi-dimensional concept of security and sustainability with weighted drivers of instability. It was challenging to build, not least because 'the term "security" is so commonly used that we may no longer wonder what it is that it really means'.⁶³ However, the dynamic and multifaceted concept of security has provided an opportunity to build an index that can evolve along with the changing nature of threats to international peace and stability.

The paper and our novel proposal for a security index should encourage dialogue about which types and levels of intervention may benefit international stability. It can serve as a useful tool both for governments and for non-governmental organisations, policymakers, corporations that aim to adopt sustainable policies and practices for long-term global security. Such efforts can also lead to increased public support and engagement in initiatives towards sustainable security. The Index can also help the international community to increase states' capacity and cooperation to build towards a more sustainable and secure future. The SSI recognises that all the dimensions of security are interrelated and sustainable security requires cooperation at the international level. It can therefore serve an international platform to tackle main challenges to international security such as border control, climate change, armed conflicts and disputes over natural resources. The index allows sustainable security to be viewed globally, nationally and regionally. It captures the dimensions of non-traditional security and prompts us to think about long-term and preventative solutions to drivers of instability.

While the index has the potential to become an international security forecasting tool, it is important to be aware of its limitations. The index can provide early warnings based on certain indicators, however, it cannot account for sudden geopolitical shifts or the specific context of

bilateral conflicts. Therefore, it should not be viewed as a definite predictor of specific conflicts or instability and is best used in conjunction with qualitative analyses. For example, the increase in military expenditure for Turkey and Greece during the same period was 1.2 per cent and -0.4 per cent respectively, and this fails to provide an early warning of the increasing tension and risk of armed conflict between the two countries after 2021. Building a security index on national data also falls short of capturing the 'highly localized nature of much conflicts'.⁶⁴ Hence, the index is not an ideal tool to dive into a particular security issue without integrating quantitative and qualitative evidence from case studies. Future research should improve the methodology by including quantified qualitative data, such as policy reviews and thematic analysis. Future studies should also monitor the rapidly developing human-AI collaboration and assess its impact on the drivers of sustainable security.

No single measure can include all the dimensions of sustainable security, nor can it completely capture the complex interrelations between the dimensions. Similarly, no single sustainable security approach will impact all countries in the same way, as drivers of insecurity differently affect countries based on their individual circumstances. Moreover, our employment of the SSI encountered limitations in terms of validity and missing data, lack of standards in normalisation and index weighting. These issues should be tackled in future research, along with conceptual questions on the integration of sustainability and security.

Notes

1. Gallie, 'Essentially Contested Concepts', 167–198; Buzan, *People, States & Fear*; Fierke, *Critical Approaches to International Security*; Schäfer, 'The Concept of Security', 5–18.
2. Walt, 'The Renaissance of Security Studies', 211; Miller, 'The Hegemonic Illusion? 639–648; Mearsheimer, *The Tragedy of Great Power Politics*.
3. Buzan, 'Rethinking Security after the Cold War', 5–28; Cha, 'Globalization and the Study of International Security', 391–403; Fierke, *Critical Approaches to International Security*; Peoples and Vaughan-Williams, *Critical Security Studies*.
4. Marinoiu et al., 'Achieving Sustainable Security', 130.
5. UN World Commission on Environment and Development, 'Report of the World Commission on Environment and Development'.
6. Levy, 'A Case for Sustainable Security Systems Engineering', 386.
7. Hama, 'State Security, Societal Security, and Human Security', 1–19; Trochowska-Sviderok, 'Sustainable Security', 369–395.
8. Zeigermann, 'Policy Coherence for Sustainable Development', 282–297.
9. Khagram et al., 'From the Environment and Human Security to Sustainable Security and Development', 289–313; Gropas, 'Functional borders, sustainable security and EU-Balkan relations', 49–76; Rogers, *Towards sustainable security*; Crawford, 'Thinking about Sustainable Security', 33–56; Akande D et al.
10. Cable, 'What is international economic security?', 305–324; Sneddon et al., 'Sustainable Development in a Post-Brundtland World', 253–268; Tataru, 'Economy as an Integral Part of National Security', 60–64.
11. Foster and Wise, 'Sustainable Security', 20–23; Voigt, 'Sustainable Security', 163–196; Lankford, *Water security*; Matthew, *Environmental security*.
12. Duhaime and Godmaire, 'The conditions of sustainable food security', 15–46; Sonnino et al., 'Sustainable Food Security', 173–188; Keskinen et al., 'Enhancing Security, Sustainability and Resilience in Energy, Food and Water', 244; David et al., 'Integrating Fourth Industrial Revolution (4IR) Technologies', 132522.
13. Paris, 'Human Security', 87–102; Thomas and Tow, 'The Utility of Human Security', 177–192; Owen, 'Human Security – Conflict, Critique and Consensus', 373–387; Matlary,

- 'Much Ado about Little', 131–143; Kavianirad, 'Assessment of the Relations between Security and Ecology', 80–100.
14. The concept of a sustainable security index was first created by the ORG, which argued that poor governance, over-reliance on military capabilities and environmental governance are key drivers of insecurity. Upon SSI's migration to the Conflict Analysis Research Centre of the University of Kent in 2020, this conceptualisation has been revised by an advisory panel of international conflict analysis experts from academia, governmental and non-governmental peacebuilding organisations, particularly in terms of methodology.
 15. Rogers, *Global security and the War on Terror*.
 16. *Ibid.*
 17. Buzan, 2007; Peoples and Vaughan-Williams, *Critical security studies*.
 18. Moran, *Foreign Direct Investment and Development*; Combes et al., 'Financial Flows and Economic Growth', 1–20.
 19. OECD, 'Foreign Direct Investment'.
 20. Moran, 'Foreign Direct Investment', 1–9.
 21. Combes et al., 'Financial Flows and Economic Growth', 195–209.
 22. Rosecrance and Thompson, 'Trade, Foreign Investment and Security', 377–398.
 23. Li, 'Foreign Direct Investment and Interstate Military Conflict', 53–66. FDI also has a significant effect on food security and has long been part of legislation and regulation debates in the context of national security. See Mihalache-O'keef and Q, 'Modernization vs. Dependency Revisited', 71–93; Wardhani and Haryanto, 'Foreign Direct Investment in Agriculture and Food Security', 513–523.
 24. World Bank.
 25. Ashby, 'Freedom and International Migration', 49–62.
 26. Global Development Research Centre, 'Human security'.
 27. Posner and Vermeule A, *Terror in the balance*.
 28. Daemen, 'Freedom, Security, and COVID-19 Pandemic', 1–21.
 29. Freedom House, 'Freedom in the World Methodology'.
 30. Ross, 'Dimensions of Militarization in the Third World', 561–578; Deger and Sen, *Military expenditure*; Eide and Thee, *Problems of Contemporary Militarism*.
 31. Dunne and Smith, 'Military Expenditure, Investment and Growth', 601–614.
 32. Fragile States Index.
 33. United Nations, 'The Sustainable Development Goals Report 2017'.
 34. Adelman, 'From Refugees to Forced Migration', 7–32.
 35. Whitaker, 'Refugees', 413–434; Hartmann, 'Rethinking Climate Refugees and Climate Conflict', 233–246; Dryzek et al., *Oxford Handbook of Climate Change and Society*. For instance, climate change aggravates environmental deterioration leading to resource scarcity and higher frequency of natural disasters such as draughts and flooding. These disasters increase the risk of conflict, cultural, economic and health-driven displacement of people both internally within countries and across international borders in search of safer and more stable living conditions.
 36. Resolution of the refugee problem requires efforts beyond humanitarian responses. For example, there is a need to develop sustainable measures to manage displacement by addressing the root causes.
 37. Koubi et al., 'Climate Variability, Economic Growth, and Civil Conflict', 335–350; Ebi and Loladze, 'Health Risks Associated With Climate Change'.
 38. Koubi, 'Exploring the Relationship between Climate Change and Violent Conflict', 197–202; Koubi et al., 'The Determinants of Environmental Migrants', 1–32; Ebi and Loladze, 'Elevated Atmospheric CO₂ Concentrations', e283–e284.
 39. McDonald, 'Climate Change and Security', 153–180.
 40. Ratner, 'Environmental Security'; Institute for Economics & Peace, 'Ecological Threat Report 2022'.
 41. Kumar and Roy, 'War and Peace', 1153; Naidoo and Fisher, 'Reset Sustainable Development Goals for a Pandemic World', 198–201.

42. Human Development Report, 'United Nations Development Programme'.
43. Institute for Economics and Peace, 'Global Peace Index 2021'.
44. Firchow and Mac Ginty, 'Measuring Peace', 6–27.
45. Singh and Hiremath, 'Sustainable Livelihood Security Index in a Developing Country', 442–451.
46. Gupta et al., 'Creating Composite Index', 148.
47. Böhringer and Jochem, 'Measuring the Immeasurable', 1–8.
48. As the indices used for the indicators had already gone through aggregation in the original data sets and to keep the index as simple as possible, we did not aggregate them under each dimension.
49. The full impact of the Covid pandemic, such as a temporary decline in the carbon emissions, is not likely to be visible in the 2021 index because of disruptions in data collection caused by lockdowns and travel restrictions.
50. Singh and Singh, 'Feature Wise normalisationnormalisation', 108307. Normalization aims to reduce the effects of outliers and overcome the challenge of combining data from different sources. While there are numerous ways of normalisationnormalisation, none has proven to be superior to others because data features vary. Our approach has been used by other indices, such as the Sustainable Development Goals Index (SDGI) and the HDI.
51. While we accept that there is no generalised rule for normalisation of data, by using a standard normalisation method throughout one study, we limited inconsistencies in handling data. The SSI does not claim to solve commensurability challenges, but we believe it is a useful step forward. At the very least, it will foster academic discussion on measuring sustainable security and improve methodology, especially the selection of indicators and handling of data.
52. GA/12191, 'Declining Aid, Rising Debt'.
53. Buzan, *People, States, and Fear*; Sen, *Development as Freedom*; Caballero-Anthony, *An Introduction to Non-Traditional Security Studies*.
54. Matthew, et al., 'Global Environmental Change'.
55. Brauch, *Handbook on Human Security*.
56. United Nations Development Programme, *Human Development Report 1994*; Baldwin, *Prospects for Peace*.
57. Jolly and Ray, 'Human Security', 11–24.
58. Newman, *Critical Perspectives on Human Security*; Krause, 'Theories of Security and Human Security'.
59. Buzan and Wæver, *Regions and Powers*.
60. Levin et al., 'Resilience in Natural Resource Management', 14.
61. For example, the Environmental Performance Index (EPI) has evolved to include new indicators that reflect emerging environmental concerns, such as climate change and air quality. Such changes are made often with the introduction of supplementary indices or parallel versions to prevent disruption in the continuity of the primary index. See SIPRI Yearbook 2016.
62. This includes documenting the rationale for any changes, providing clear explanations of how new indicators are integrated and ensuring that users of the index understand how these changes might affect the interpretation of trends. To address new dimensions without disrupting the existing index, Schippa (2011), Institute for Economics & Peace (2021) and SIPRI (2016) suggest creating supplementary or parallel indices. This allows for the exploration of new areas of interest (e.g. the HDI exploring new dimensions of security) without compromising the integrity of the original index. This approach ensures that the original index remains consistent over time, while new or emerging factors are still measured and monitored. Also see Folke, et al., 'Regime Shifts, Resilience', 557–586. doi:10.1146/annurev.ecolsys.36.091704.173567.
63. Akande et al., *Human Rights and 21st Century Challenges*.
64. Firchow and Ginty, 'Measuring Peace', 6–27.

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Data availability statement

The data that support the findings of this study are available at doi: 10.4121/cd42d135-d79f-4868-b8be-9611171c0099.

These data were derived from the following resources available in the public domain:

World Bank Open Data: <https://data.worldbank.org/>

Freedom House: <https://freedomhouse.org/report/freedom-world>

Stockholm International Peace Research Institute (SIPRI) Military Expenditures Database: <https://www.sipri.org/databases/milex>

Fragile States Index (FSI): <https://fragilestatesindex.org/analytics/>

Global Peace Index (GPI): <https://www.visionofhumanity.org/public-release-data/>

UNHCR Refugee Data Finder: <https://www.unhcr.org/refugee-statistics/>

Vision of Humanity: <https://www.visionofhumanity.org/maps/ecological-threat-report/#/>

Global Carbon Atlas of the Global Carbon Project: <https://globalcarbonatlas.org/>

Sustainable Development Report: <https://dashboards.sdgindex.org/explorer>

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Appendix

No. of indicators with missing data		1		2		3		4	
Rank	State	Rank	State	Rank	State	Rank	State	Rank	State
1	New Zealand	57	Oman	113	Haiti				
2	Portugal	58	Bolivia	114	Azerbaijan				
3	Ireland	59	Peru	115	Egypt				
4	Sweden	60	Kuwait	116	Bangladesh				
5	Canada	61	Nepal	117	Eswatini				
6	Germany	62	The Gambia	118	India				
7	Denmark	63	Gabon	119	Turkey				
8	Czech Republic	64	Bhutan	120	Rwanda				
9	Japan	65	Moldova	121	Congo (Brazzaville)				
10	Poland	66	Botswana	122	Thailand				
11	Slovenia	67	Colombia	123	Burkina Faso				
12	United Kingdom	68	Vietnam	124	Djibouti				
13	Switzerland	69	Armenia	125	Angola				
14	Costa Rica	70	Indonesia	126	Saudi Arabia				
15	Bulgaria	71	China	127	Tajikistan				
16	Romania	72	Lesotho	128	Philippines				
17	Estonia	73	Honduras	129	Kyrgyzstan				
18	Lithuania	74	Cambodia	130	Cuba				
19	Finland	75	Georgia	131	Uzbekistan				
20	Australia	76	Cyprus	132	Mozambique				
21	Norway	77	Serbia	133	Equatorial Guinea				
22	Austria	78	Tunisia	134	Russia				
23	France	79	Timor-Leste	135	Turkmenistan				
24	Hungary	80	Papua New Guinea	136	Myanmar				
25	Uruguay	81	Qatar	137	Uganda				
26	Croatia	82	Guatemala	138	Kenya				
27	Latvia	83	Zambia	139	Burundi				
28	Netherlands	84	Israel	140	Iran				
29	Belgium	85	Jordan	141	Niger				
30	Spain	86	Benin	142	Cabo Verde				
31	Singapore	87	Nicaragua	143	Nigeria				
32	Slovakia	88	United Arab Emirates	144	Venezuela				
33	Mongolia	89	Laos	145	Cameroon				
34	Greece	90	Morocco	146	Ethiopia				
35	Argentina	91	Malawi	147	Congo D.R.				
36	Chile	92	Sri Lanka	148	Mali				
37	Malaysia	93	Luxembourg	149	Fiji				
38	Montenegro	94	Togo	150	Sudan				
39	Ghana	95	Trinidad and Tobago	151	Zimbabwe				
40	South Korea	96	Liberia	152	Suriname				
41	Panama	97	Cote d'Ivoire	153	Iraq				
42	Guyana	98	Namibia	154	Chad				
43	Paraguay	99	Algeria	155	Pakistan				
44	Sierra Leone	100	Bahrain	156	Eritrea				
45	United States of America	101	North Macedonia	157	Maldives				
46	Italy	102	Jamaica	158	Dem. Rep. of N. Korea				
47	Brazil	103	Lebanon	159	Central African Republic				
48	Albania	104	Ukraine	160	Libya				
49	South Africa	105	Madagascar	161	Solomon Islands				
50	Bosnia and Herzegovina	106	Guinea	162	Kosovo				
51	El Salvador	107	Tanzania	163	Comoros				
52	Mauritius	108	Mauritania	164	Somalia				
53	Senegal	109	Belarus	165	Yemen				
54	Kazakhstan	110	Guinea-Bissau	166	Afghanistan				
55	Dominican Republic	111	Mexico	167	South Sudan				
56	Ecuador	112	Malta	168	Syria				