

The Impact of the Availability and Accessibility of Official Statistics on Sustainable Development Indicators in Arab Countries: An Empirical Study Using Structural Equation Modeling (SEM)

BOUATELLI Mohamed^{1, *}

¹ Higher School of Management and Digital Economy (Algeria)
mbouatelli@esgen.edu.dz

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Abstract:

This study examines the relationship between the availability and accessibility of official statistics, measured by the ODIN index, and development performance reflected in the SDG indicators for sixteen Arab countries in 2022, across the economic, social, and environmental dimensions of sustainable development. Relying on official international data and modern econometric methods, the analysis highlights the role of statistical capacity in shaping development outcomes.

The findings show that social data on education, health, and justice significantly support economic performance, while economic data contribute to environmental improvement through better resource allocation. By contrast, environmental data alone did not produce a direct effect, underscoring the need for policy integration. Overall, the results stress that investing in statistical infrastructure, enhancing transparency, and expanding data access are critical to advancing sustainable development in all three dimensions.

Keywords: Open Data; ODIN Indicators; SDG Indicators; Sustainable Development; Arab Countries.

Jel Classification Codes : C38; C55; O10; O44; Q56.

* Corresponding author: BOUATELLI Mohamed, e-mail: mbouatelli@esgen.edu.dz

Introduction

Official statistics, their availability, and accessibility have become fundamental pillars in formulating evidence-based public policies, as they provide transparency, accountability, and trust, in addition to serving as a supportive tool for researchers as well as the public and private sectors. In the Arab context, where economic growth challenges intersect with social and environmental requirements, the question arises as to the extent to which the availability and openness of official statistics can generate a tangible impact on sustainable development indicators.

This study draws on a recent database covering sixteen Arab countries for the year 2022. It relies on the Open Data Inventory (ODIN) issued by Open Data Watch to measure the level of coverage and accessibility of official statistics across social, economic, and environmental dimensions, alongside selected indicators from the World Bank databases that reflect the actual performance of the Sustainable Development Goals (SDGs) in the same three dimensions.

Methodologically, the study adopts an empirical approach that combines:

- Constructing composite indicators for each ODIN and SDG dimension using Principal Component Analysis (PCA), based on the first principal component (PC1) of each dimension;
- Estimating the structural effect of ODIN dimensions on SDG dimensions using Structural Equation Modeling (SEM) in order to identify both direct and indirect pathways of influence.

This approach enables the transition from quantitative monitoring to the testing of structured causal relationships between the availability and accessibility of official statistics, on the one hand, and actual development performance, on the other. It thus provides Arab policymakers with a practical tool to guide data policies toward achieving more balanced and sustainable economic, social, and environmental development.

Within this framework, the main research question can be formulated as follows:

What is the nature of the relationship between the level of availability and accessibility of official statistics (ODIN) and the actual development performance (SDG) in Arab countries in 2022 across the three dimensions (social, economic, environmental)?

To address this question, the study assumes the following hypothesis:

- There is a positive relationship between the level of availability and accessibility of official statistics (ODIN) and actual development performance (SDG) in Arab countries in 2022 across the three dimensions (social, economic, environmental).

The significance of this research lies in its focus on a contemporary and vital issue, namely, the relationship between the level of availability and accessibility of official statistics (ODIN) and actual development performance (SDG) in Arab countries. Accurate and up-to-date statistics are an essential tool for decision-making and public policy formulation, while their transparent availability enhances countries' ability to monitor progress toward achieving the Sustainable Development Goals across their three dimensions: social, economic, and environmental.

From this perspective, the study seeks to fill an important knowledge gap by highlighting the pivotal role of official statistics in supporting development efforts and by providing practical results that may assist policymakers in the Arab region in guiding reforms and improving data collection and dissemination systems in line with the requirements of sustainable development.

I. Conceptual Framework of the Study

This section of the study presents and discusses the key concepts related to open data and sustainable development, with the aim of clarifying the theoretical foundations of the research and enhancing the understanding of its dimensions.

I. 1. Conceptual Framework of Open Data

I. 1. 1. The Concept of Open Data

Data represent a primitive description of reality, such as a measurement, a value, or an observation. In their raw form, data remain devoid of any analysis, inference, or assumption. They are also not subject to discussion or debate and are valid only for research or examination purposes. (Al-Salami, 2019)

Open data, on the other hand, are data that can be freely used, reused, and redistributed by anyone, provided that users attribute the data to their sources and that derivative works are also made available for sharing. (Ubaldi, 2013)

This is a relatively new concept that emerged in 2009 in the United States and the United Kingdom as a new approach aimed at: (Al-Salami, 2019)

- Managing and publishing public data;
- Promoting internal cooperation between government entities and external collaboration with non-governmental actors;
- Supporting transparency by enabling citizens to assess government policies.

I. 1. 2. Accessibility of Data

The essence of open data does not lie merely in its availability, but also in the ease of access by all stakeholders without discrimination. Accessibility is considered a fundamental condition for enabling individuals and institutions to make effective use of data, transforming it into knowledge applicable to decision-making, innovation, and scientific research.

Accessibility can be achieved through:

- Publishing data in standardized, machine-readable formats that allow for automated processing;
- Providing data on national or international centralized platforms that ensure ease of search and use;
- Regularly updating data and making it available as soon as it is collected to ensure timeliness and value;
- Ensuring data comprehensiveness so that it covers various domains (economic, social, environmental);
- Making data available free of charge and without requiring complex procedures or prior registration.

I. 1. 3. Core Principles of Open Data and Accessibility

Open data constitutes a cornerstone for enhancing transparency, accountability, and fostering innovation across various fields. It enables citizens, researchers, the private sector, and government entities to access public information and reuse it in ways that contribute to improving public services, stimulating economic and social development, and enhancing community participation in decision-making.

To ensure optimal benefit from open data, a set of key principles and general rules has been established to govern how it should be provided and used: (Human Rights Commission, 2021)

❖ Principle 1: Availability by Default

Public sector data must be made available to everyone through disclosure, access, or use, unless its nature requires non-disclosure or protection of privacy or confidentiality.

❖ Principle 2: Open Format and Machine Readability

Data must be made available in machine-readable formats that allow automated processing, stored in commonly used file types.

❖ Principle 3: Timeliness of Data

The latest versions of open datasets must be published regularly and made available as soon as they are collected. Aggregated data from public entities should also be published promptly, with priority given to data whose value decreases over time.

❖ Principle 4: Comprehensiveness

Open datasets should be comprehensive and as detailed as possible, reflecting recorded data without conflicting with personal data protection policies. Metadata must be included to explain the primary data, along with formulas or calculations used in deriving or compiling them.

❖ Principle 5: Non-Discrimination

Datasets must be made available to everyone without discrimination and without requiring registration, so that any person can access open data at any time without identity verification or justification.

❖ Principle 6: Free of Charge

Open data must be made freely available to all.

❖ **Principle 7: Open Data Licensing**

Open data must be subject to licenses that define the legal basis for their use, including conditions, obligations, and restrictions on users. Use of open data is considered implicit acceptance of licensing terms.

❖ **Principle 8: Governance and Inclusive Participation**

Open data should promote access and participation for all, enhancing transparency and accountability of public entities, while supporting decision-making and service delivery.

❖ **Principle 9: Inclusive Development and Innovation**

Public entities are expected to play an active role in encouraging the reuse of open data by providing resources and expertise to support it. They must work in coordination with stakeholders to empower the next generation of innovators in open data and engage individuals, institutions, and society at large in unlocking its potential.

I. 2. The Conceptual Framework of Sustainable Development

I. 2. 1. The Concept of Sustainable Development

Some of the most significant definitions of sustainable development include:

OECD Definition: Sustainable development consists of a deeper articulation of the relationship between economic activity and the preservation of environmental resources. It is also based on the partnership between the environment and the economy. (Al-Khawaja, 2006)

World Bank Definition: Sustainable development is development that meets the needs of present societies without compromising the ability of future generations to achieve their own goals. It allows for better opportunities than those available to the current generation to achieve economic, social, and human progress. Sustainable development is considered an indispensable link between short-term and long-term objectives. (Bouaâcha, 2008)

I. 2. 2. Dimensions of Sustainable Development

Achieving sustainable development essentially requires addressing its three fundamental dimensions: economic, social, and environmental.

- ❖ **Economic Dimension:** This dimension revolves around the current and future impacts of the economy on the environment. Economic growth should be pursued in a way that incorporates the value of environmental assets and preserves natural capital. (Kerbali & Hamdani, 2010)
- ❖ **Social Dimension:** The social dimension emphasizes the development of human resources by focusing on health, education, and cultural aspects, while enhancing society's capacity to overcome poverty and achieve social justice. (Louis & others, 2014)
- ❖ **Environmental Dimension:** This dimension stresses that sustainable development must respect environmental limits, as each ecosystem has specific thresholds that cannot be exceeded in terms of consumption and exploitation. Crossing those limits leads to the degradation of the ecosystem. (Marzouq, Al-Shammari, & others, 2016)

II. Study Presentation

II. 1. Sample and Study Period

This study focuses on sixteen Arab countries, namely: the United Arab Emirates, Bahrain, Algeria, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, and Yemen. The reference period is the year 2022, with the aim of providing an updated analysis based on the available open data for these countries.

II. 2. Data Sources

The study relies on data from the Open Data Inventory (ODIN), published by (Open Data Watch, 2025), which is an internationally recognized tool for assessing the coverage and openness of official statistics. In addition, sustainable development indicators were obtained from (World Bank, 2025), in order to ensure a comprehensive analysis that takes into account the economic, social, and environmental dimensions.

II. 3. Study Variables

This study includes a set of variables related to the indicators of official statistics availability and accessibility (ODIN) and sustainable development indicators (SDGs), classified according to the three main dimensions: economic, social, and environmental.

In the social dimension, the study covers ten ODIN-related variables: population and vital statistics, educational facilities, educational outcomes, health facilities, health outcomes, reproductive health, food security and nutrition, gender statistics, crime and justice, and poverty and income. In addition, two SDG-related variables are included: life expectancy at birth and adult literacy rate.

For the economic dimension, the analysis considers seven ODIN variables: national accounts, employment, price indicators, public finance, money and banking, international trade, and balance of payments. It also incorporates three SDG indicators: GDP per capita, gross fixed capital formation, and the unemployment rate.

Within the environmental dimension, the study employs five ODIN variables: agriculture and land use, resource use, energy, pollution, and the built environment. Additionally, two SDG indicators are included: carbon dioxide emissions from fugitive sources and renewable energy consumption.

ODIN variables represent the coverage and accessibility of official statistics for each country, whereas SDG variables reflect the actual values of development indicators, with the appropriate measurement unit specified for each variable.

For clarity and analytical consistency, the variable names are presented in an abbreviated form in the following table (Table 1), indicating the dimension and source of each variable. This classification contributes to examining the impact of official statistics availability and accessibility on the development performance of Arab countries during 2022.

Table (1): Study Variables, Dimensions, and Sources

Indicator / Source	Dimension	Code	Variable
ODIN	Social	POP	Coverage of population and vital statistics data (%)
ODIN	Social	EDU_FAC	Coverage of education facilities data (%)
ODIN	Social	EDU_OUT	Coverage of educational outcomes data (%)
ODIN	Social	HLTH_FAC	Coverage of health facilities data (%)
ODIN	Social	HLTH_OUT	Coverage of health outcomes data (%)
ODIN	Social	REP_HLTH	Coverage of reproductive health data (%)
ODIN	Social	FOOD_SEC	Coverage of food security and nutrition data (%)
ODIN	Social	GENDER	Coverage of gender statistics (%)
ODIN	Social	CRIME_JUST	Coverage of crime and justice data (%)
ODIN	Social	POV_INC	Coverage of poverty and income data (%)
ODIN	Economic	NAT_ACC	Coverage of national accounts data (%)
ODIN	Economic	LABOR	Coverage of labor market data (%)
ODIN	Economic	PRICE_IDX	Coverage of price indicators (%)
ODIN	Economic	GOV_FIN	Coverage of public finance data (%)
ODIN	Economic	MONEY_BANK	Coverage of money and banking data (%)
ODIN	Economic	TRADE	Coverage of international trade data (%)
ODIN	Economic	BOP	Coverage of balance of payments data (%)
ODIN	Environmental	AGRI_LAND	Coverage of agriculture and land use data (%)

ODIN	Environmental	RES_USE	Coverage of resource use data (%)
ODIN	Environmental	ENERGY	Coverage of energy data (%)
ODIN	Environmental	POLLUT	Coverage of pollution data (%)
ODIN	Environmental	BUILT_ENV	Coverage of built environment data (%)
SDG	Economic	GDPC	GDP per capita (US\$)
SDG	Economic	GFCF	Gross fixed capital formation (% of GDP)
SDG	Economic	UNEMP_TOT	Unemployment rate (% of total labor force)
SDG	Social	LIFE_EXP	Life expectancy at birth (years)
SDG	Social	LIT_ADULT	Adult literacy rate (% ages 15 and above)
SDG	Environmental	CO2_FUG_EN	Carbon dioxide emissions from fugitive sources (Mt CO ₂ e)
SDG	Environmental	REN_EN_CONS	Renewable energy consumption (% of total final energy consumption)

Source: Prepared by the author based on data from (Open Data Watch, 2025) and (World Bank, 2025)

III. Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is one of the most widely used multivariate statistical techniques, as it allows for the simplification of large and complex datasets into principal components that reduce redundancy and multicollinearity among variables, while retaining as much of the original variance as possible.

In this section, PCA is employed to construct a composite index for each of the three dimensions (social, economic, and environmental), both for the indicators of official statistics availability and accessibility as well as for the sustainable development indicators. This approach facilitates the assessment of gaps among Arab countries in terms of data availability and development performance.

III. 1. Principal Component Analysis (PCA) of Official Statistics Availability and Accessibility Indicators

PCA was applied to the social, economic, and environmental indicators of official statistics availability and accessibility for the Arab countries in 2022.

As shown in Table (2), the first principal component (PC1) explains approximately 71.6% of the variance in the social indicators, making it a strong composite measure for assessing the social performance of Arab countries in terms of official statistics availability and accessibility. This composite index enables cross-country comparisons in the areas of education, health, food security, gender, and social justice, and serves as an effective tool for data-driven decision-making.

Table (2): Composite Index of the Social Dimension of Official Statistics Availability and Accessibility for Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	2.676	0.716	0.716
PC2	0.92967	0.08643	0.80243
PC3	0.7662	0.0587	0.8611
PC4	0.66201	0.04383	0.90496
PC5	0.57522	0.03309	0.93805
PC6	0.5167	0.0267	0.9647
PC7	0.38869	0.01511	0.97986
PC8	0.36652	0.01343	0.99329
PC9	0.21962	0.00482	0.99811
PC10	0.13738	0.00189	1.00000

Source: Prepared by the author using R statistical software

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In the same context, Table (3) shows that PC1 explains approximately 71.17% of the variance in the economic indicators, providing a composite index for assessing the economic performance of Arab countries in terms of official statistics availability and accessibility. This index encompasses indicators such as national accounts, employment, price indices, public finance, money and banking, international trade, and balance of payments. It contributes to facilitating cross-country comparisons and enhancing evidence-based economic planning.

Table (3): Composite Index of the Economic Dimension of Official Statistics Availability and Accessibility for Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	2.2321	0.7117	0.7117
PC2	0.9522	0.1295	0.8413
PC3	0.68404	0.06684	0.90810
PC4	0.53218	0.04046	0.94856
PC5	0.45087	0.02904	0.97761
PC6	0.32948	0.01551	0.99311
PC7	0.21955	0.00689	1.00000

Source: Prepared by the author using R statistical software

Similarly, Table (4) shows that PC1 explains approximately 67.04% of the variance in the environmental indicators, providing a composite index for assessing the environmental performance of Arab countries. This index covers areas such as agricultural land use, resource consumption, energy, pollution, and the built environment. It helps in understanding environmental disparities among countries and supports sustainable planning.

Table (4): Composite Index of the Environmental Dimension of Official Statistics Availability and Accessibility for Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	1.8309	0.6704	0.6704
PC2	0.8626	0.1488	0.8192
PC3	0.7782	0.1211	0.9404
PC4	0.51968	0.05401	0.99438
PC5	0.16770	0.00562	1.00000

Source: Prepared by the author using R statistical software

In conclusion, the first principal component (PC1) captures the largest share of the total variance in each dimension of the indicators of official statistics availability and accessibility—whether social, economic, or environmental. Relying on this component in each dimension made it possible to construct a strong composite index that reflects the most significant information for each aspect, thereby enabling accurate and consistent cross-country comparisons and performance analysis among Arab countries.

III. 2. Principal Component Analysis (PCA) of of Sustainable Development Indicators

The Principal Component Analysis (PCA) method was applied to the social, economic, and environmental indicators related to the Sustainable Development Goals (SDGs) for Arab countries in 2022.

The following table shows that the first principal component (PC1) explains approximately 80% of the variance in the social indicators, providing a strong composite index for assessing the social performance of Arab countries in terms of SDG indicators.

Table (5): Composite Index of the Social Dimension of the Sustainable Development Goals (SDGs) for Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	1.549	0.800	0.800
PC2	0.6642	0.1471	0.9470
PC3	0.3986	0.0530	1.0000

Source: Prepared by the author using R statistical software

Table (6) shows that the first principal component (PC1) explains approximately 62.94% of the variance in the economic indicators of the Sustainable Development Goals (SDGs). This makes it a strong composite index for evaluating the economic performance of Arab countries in terms of SDG indicators.

Table (6): Composite Index for the Economic Dimension of the Sustainable Development Goals (SDGs) in Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	1.1219	0.6294	0.6294
PC2	0.8610	0.3706	1.0000

Source: Prepared by the author using R statistical software

Table (7) shows that the first principal component (PC1) explains approximately 77.49% of the variance in the environmental indicators, providing a strong composite index for assessing the environmental performance of Arab countries according to the SDG indicators.

Table (7): Composite Index for the Environmental Dimension of the Sustainable Development Goals (SDGs) in Arab Countries, 2022

Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	1.2449	0.7749	0.7749
PC2	0.6709	0.2251	1.0000

Source: Prepared by the author using R statistical software

In conclusion, the results indicate that the first principal component (PC1) accounts for the largest share of the total variance in each dimension of sustainable development, whether social, economic, or environmental. Relying on this component allowed the construction of robust composite indices that capture the most relevant information for each dimension, thereby enabling accurate and standardized comparisons across Arab countries and facilitating a comprehensive analysis of their performance.

IV. Estimating the Impact of the Availability and Accessibility of Official Statistics on Sustainable Development Indicators Using SEM

In this section, we highlight the use of Structural Equation Modeling (SEM) as an advanced tool to study causal relationships between multidimensional variables and to estimate the impact of the different dimensions of the availability and accessibility of official statistics on sustainable development indicators in Arab countries for the year 2022. SEM is considered one of the most modern and powerful statistical methods in data science and econometrics, as it enables the analysis of complex relationships among multiple variables simultaneously, while also accommodating latent and composite variables rather than being limited to observed variables only.

In this study, we utilized the results of the Principal Component Analysis (PCA) applied to both the availability and accessibility of official statistics and sustainable development indicators.

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The first principal component (PC1) for each dimension (social, economic, and environmental) was selected as a composite indicator. This composite index provides the best representation of the respective dimension, as it captures the largest proportion of the total variance of the sub-variables within each dimension, ensuring that the model retains the essential information without the loss of critical data.

Using these three composite indicators as independent variables, we estimated their effects on the corresponding sustainable development dimensions, which were treated as dependent variables within the SEM framework. This estimation allows us to understand how each dimension of the availability and accessibility of official statistics contributes to improving the social, economic, and environmental performance of Arab countries, while also identifying the dimensions with the strongest influence on sustainable development.

This approach stands out for its novelty and analytical strength in handling aggregated and complex data, as it combines data reduction into composite indicators with the estimation of causal relationships between these indicators and final outcomes. This dual advantage makes the results more reliable and interpretable compared to traditional methods such as simple multiple regression.

Table (8) presents the main results of the SEM estimation:

Table (8): Estimation of the Impact of the Availability and Accessibility of Official Statistics on Sustainable Development Indicators Using the Structural Equation Modeling (SEM) Approach for Arab Countries, 2022

Dependent Variable	Independent Variable	Estimate	Standard Error	z-value	p-value	Standardized Coefficient
Economic Index of Sustainable Development	Social Index of the Availability and Accessibility of Official Statistics	0.536	0.212	2.530	0.011	1.278
	Economic Index of the Availability and Accessibility of Official Statistics	0.058	0.202	0.287	0.774	0.115
	Environmental Index of the Availability and Accessibility of Official Statistics	-0.586	0.302	-1.937	0.053	-0.956
Social Index of Sustainable Development	Social Index of the Availability and Accessibility of Official Statistics	0.174	0.315	0.552	0.581	0.300
	Economic Index of the Availability and Accessibility of Official Statistics	0.475	0.300	1.583	0.113	0.685
	Environmental Index of the Availability and Accessibility of Official Statistics	-0.420	0.449	-0.934	0.350	-0.496
Environmental Index of Sustainable Development	Social Index of the Availability and Accessibility of Official Statistics	-0.489	0.256	-1.910	0.056	-1.051
	Economic Index of the Availability and Accessibility of Official Statistics	0.480	0.244	1.967	0.049	0.861
	Environmental Index of the Availability and Accessibility of Official Statistics	0.303	0.366	0.830	0.407	0.446

Source: Prepared by the author using R statistical software

V. Interpretation of the SEM Results on the Impact of the Availability and Accessibility of Official Statistics on Sustainable Development Indicators

V.1. Impact on the Economic Dimension of Sustainable Development

The results indicate that the social dimension of the availability and accessibility of official statistics exerts a positive and statistically significant effect on sustainable economic performance ($p = 0.011$). This finding highlights the importance of reliable social data—such as education, health, social justice, and food security—in shaping evidence-based economic policies. High-quality social information strengthens human capital and guides investments, thereby improving the overall economic performance of Arab countries.

By contrast, the economic dimension of official statistics availability does not show a statistically significant effect ($p = 0.774$). This suggests that simply having access to economic data is insufficient; without active integration into policymaking and strategic planning, such data cannot effectively drive sustainable economic development.

The environmental dimension displays a negative effect that is marginally significant ($p = 0.053$). This may imply that the disclosure of environmental challenges—such as emissions and resource depletion—could initially hinder economic performance unless accompanied by integrated economic and environmental policies that mitigate these constraints.

V.2. Impact on the Social Dimension of Sustainable Development

None of the three dimensions of official statistics availability showed a direct and statistically significant impact on the social dimension. However, the economic dimension displayed a moderate positive effect ($p = 0.113$). This suggests that economic statistics may indirectly enhance social development by informing policies that improve employment opportunities, income distribution, and public services, which in turn contribute to better education, healthcare, and overall social well-being.

V.3. Impact on the Environmental Dimension of Sustainable Development

The results reveal that the economic dimension of the availability and accessibility of official statistics has a positive and statistically significant effect on environmental development ($p = 0.049$). This finding underscores the role of economic data in enabling policymakers to allocate resources more effectively toward sustainable environmental projects, such as renewable energy or green infrastructure.

Meanwhile, the social dimension exhibits a negative effect that is close to statistical significance ($p = 0.056$). This calls for a deeper examination of the link between social factors and environmental outcomes, as certain behaviors or practices may have adverse ecological impacts in the absence of awareness or adequate regulatory frameworks.

The environmental dimension itself did not show a significant direct effect. This implies that the mere availability of environmental statistics is not sufficient; their integration into actionable policies and programs is essential to achieve tangible environmental improvements.

V.4. Conclusions and Policy Implications

The results of the Structural Equation Modeling (SEM) emphasize that the availability and accessibility of official statistics are a cornerstone in supporting the dimensions of sustainable development in Arab countries, though their impact varies according to the nature of each dimension. The findings reveal that the social dimension of statistics exerts a direct and significant effect on economic performance, while the economic dimension of statistics plays a pivotal role in strengthening the environmental dimension. Conversely, the influence of the environmental and social dimensions on environmental and social development remains limited or indirect, highlighting the need for more effective activation mechanisms.

Key policy implications include:

- Investing in the quality of social data strengthens policymakers' ability to design more targeted and equitable economic policies;
- Linking economic data with sustainable environmental plans allows resources to be directed toward initiatives with tangible impacts on environmental sustainability;

- Environmental and social data alone are insufficient unless they are integrated into actionable policies, supported by awareness programs, and backed by strong institutions capable of transforming data into effective action.

Conclusion

This study aimed to evaluate the impact of the availability and accessibility of official statistics, as measured by ODIN indicators, on sustainable development performance, represented by SDG indicators, in sixteen Arab countries for the year 2022. The study adopted a methodology that combines Principal Component Analysis (PCA) to condense multiple indicators into composite indices, and Structural Equation Modeling (SEM) to uncover the causal relationships between the dimensions of data availability and the dimensions of sustainable development.

The results of the PCA showed that the first component (PC1) represents a strong composite indicator for each of the three dimensions. It explained about 71.6% of the variance in the social dimension, 71.17% in the economic dimension, and 67.04% in the environmental dimension for the ODIN indicators, while it explained 80% of the variance in the social dimension, 62.94% in the economic dimension, and 77.49% in the environmental dimension for the SDG indicators. This demonstrates that the first component largely captures the underlying variance in the data and provides a reliable tool for constructing composite indicators that allow for precise and standardized comparisons across countries.

The results of the SEM revealed several important causal relationships. It was found that the social dimension of data availability has a positive and significant effect on sustainable economic performance, confirming that the quality and availability of social data related to education, health, food, and social justice contribute to supporting economic policy-making and improving the performance of Arab economies. The results also showed that the economic dimension of data availability has a positive impact on environmental development, indicating that economic information enables policymakers to allocate resources more effectively to support sustainable environmental projects.

In contrast, the environmental dimension of data availability did not show a statistically significant direct effect on the other dimensions of sustainable development. This suggests that the availability of environmental data alone is not sufficient to enhance environmental development unless it is linked to concrete plans and policies that ensure tangible results. Some marginally significant negative relationships were also observed, such as the negative effect of the social dimension of data availability on environmental development, and the negative effect of the environmental dimension of data availability on economic development. These findings call for cautious interpretation, as they may be related to institutional or administrative factors that hinder the effective translation of data into sound policy actions.

Overall, the results confirm that the availability and accessibility of official statistics constitute a fundamental basis for promoting sustainable development in Arab countries, though their effects vary depending on the dimension. Social data clearly contribute to improving economic performance, while economic data enhance environmental performance. Environmental data, however, do not necessarily lead to tangible development outcomes unless embedded in practical policies. At the same time, the absence of data or their mismanagement remains a key factor limiting the ability of Arab countries to improve their sustainable development indicators.

Based on these findings, the following recommendations can be proposed:

- Strengthen the integration of economic, social, and environmental data to ensure a comprehensive vision that helps policymakers design balanced development plans;
- Develop advanced analytical tools to transform open data into measurable indicators that effectively inform policy formulation;
- Encourage community participation and partnerships with the private sector, universities, and civil society in collecting, analyzing, and using data to enhance transparency and effectiveness;
- Regularly monitor and evaluate performance through periodic tracking indicators to assess the impact of open data use on economic, social, and environmental development, with policies adjusted accordingly.

Referrals and references

- Al-Khawaja, A. M. (2006). *Globalization and Sustainable Development: The Arab Encyclopedia of Knowledge for Sustainable Development*. Beirut: Arab Scientific Publishers.
- Al-Salami, K. (2019). Open Data: Principles, Strategy, and Programs. *Workshop on Open Government and Emerging Technologies in the Arab Region*. Beirut: Organized by the Economic and Social Commission for Western Asia (ESCWA), United Nations, ESCWA.
- Bouaâcha, M. (2008). Sustainable Development: An Economic Approach to the Problematic of Concepts. *International Scientific Conference on Sustainable Development and the Efficient Use of Available Resources*. Setif: Ferhat Abbas University.
- Human Rights Commission. (2021). *Open Data Policy*. Kingdom of Saudi Arabia: Data Management Office.
- Kerbali, B., & Hamdani, M. (2010). Strategies and Policies of Sustainable Development in Light of Economic and Technological Transformations in Algeria. *Journal of Human Sciences*, (45) .
- Louis, G., & others. (2014). *The Challenges and Issues of Sustainable Development: Knowing, Deciding, and Acting*. Canada: Laval University Press.
- Marzouq, H., Al-Shammari, A., & others. (2016). *The Green Economy: A New Path in Sustainable Development*. Amman: Dar Al-Ayyam for Publishing and Distribution.
- Open Data Watch. (2025). *ODIN 2022/23 biennial report* . Consulté le 03 01, 2025, sur <https://odin.opendatawatch.com/Report/biennialReport2022>
- Ubaldi, B. (2013). *Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives*. Paris: OECD Working Papers on Public Governance, No. 22, OECD Publishing.
- World Bank. (2025). *World Bank Indicators*. Retrieved 04 01, 2025, from <https://data.albankaldawli.org/indicator>