

EXPLORING INCLUSIVE SUSTAINABILITY PAIRED WITH THE SUSTAINABLE DEVELOPMENT GOALS AND THE OFFICIAL DEVELOPMENT ASSISTANCE. A DATA-DRIVEN AND EVIDENCE-BASED NATIONAL EXPERIENCE

Teodora I. BIȚOIU
Mădălina COCOȘATU

Teodora I. BIȚOIU

Associate Professor, Faculty of Public Administration,
National University of Political Studies and
Public Administration, Bucharest, Romania
E-mail: teodora.bitoiu@administratiepublica.eu

Mădălina COCOȘATU

Associate Professor, Faculty of Public Administration,
National University of Political Studies and
Public Administration, Bucharest, Romania
E-mail: madalina.cocosatu@administratiepublica.eu

Abstract

This paper is thought as an exploratory case of reaching two policy objectives, inclusion and sustainability, by the fourth EU institutions' bilateral Official Development Assistance (ODA) recipient – Moldova (after Ukraine, Turkey and Serbia, in 2023, according to OECD Reports), as an EU candidate country, also the most committed to sustainable, fair and equitable human development, according to Coherence Index of the European Commission and the Sustainable Development Goals (SDGs). The research seeks to use Tinbergen's model of two objectives: inclusion and sustainability, and two instruments: ODA and SDGs, one for each objective of the researched objectives, aiming to prove that this is a more effective way to bring growth and yield faster results in line with the EU targets. Using this, the researchers seek to propose a way that can lead to more effective and predictable policy outcomes.

The research addresses the concept of inclusive sustainability in relation to the scores for three selected SDGs (11, 12, and 17) and to the indicator for the net official development assistance and official aid received, aiming to provide better support for developing policies that allow all citizens to get involved in the co-creation of eco-conscious behaviors and co-producing sustainable and inclusive growth.

Keywords: inclusive sustainability, Tinbergen's model, Official Development Assistance, Sustainable Development Goals (11, 12, and 17).

1. Introductory remarks

A decade after the Sustainable Development Goals were adopted, the urgency of translating their aspirational targets into tangible reforms has never been greater. To achieve truly inclusive sustainability, policymaking must become sharper and more decisive – what we might call ‘sharktoothed’ changes that bite into entrenched practices and transform theory into reality. This paper explores how Moldova – Europe’s most committed SDG candidate country and, in 2023, the fourthlargest recipient of EU institutions’ bilateral official development assistance after Ukraine, Turkey, and Serbia – uses ODA and SDG-aligned reforms to pursue twin objectives of social inclusion and environmental sustainability. Drawing on Tinbergen’s two-objectives-two-instruments framework, we posit that assigning ODA as a lever for inclusion and the SDGs as a lever for sustainability offers a more effective route to equitable growth, rooted in trust and knowledge economies. By examining Moldova’s experience, we aim to show how such a policy mix can reshape the fabric of development and deliver faster, more predictable progress towards EU targets.

By turning to both theory and practice, we searched in-depth evidence to validate our assumption that, due to the accelerating need to reach both objectives, the appropriate use of two bespoke instruments would bring more meaning to turning targets into facts and theory into reality. For its ten-year celebration, the SDGs must prove that they have reshaped the fabric of sustainable growth and that ODA pledged to fix the inclusive growth problem. Following Tinbergen’s model, we hypothesize that (H1) higher ODA correlates positively with inclusion-oriented SDGs (11 and 17), and (H2) SDG 12 may show weaker alignment, reflecting structural challenges in consumption and production.

The research only refers to SDG 11, 12 and 17, not only to narrow the scope, but the three selected SDGs meet all needed requirements to achieve inclusive sustainability, among which: SGD 11 with its aim to fix the urban inequalities and sustainability challenges, SDG 12 providing the needed links between sustainability and fairness, way of living and affordability, and SDG 17 ensuring that all parts of the communities are included.

These three SDGs were selected because they represent the urban-economic-partnership nexus that defines inclusive sustainability (Gupta and Vegelin, 2016). SDG 11 addresses spatial inclusion through sustainable cities; SDG 12 captures the fairness-resource efficiency dimension; and SDG 17 operationalizes cooperation and governance. Together, they form a coherent triad covering social, environmental, and institutional inclusion. Comparable selections are found in Beccarello and Foggia (2022) and Chongtham *et al.* (2024), who analyze similar integrative sustainability frameworks. To even further ground the connection, recent evidence confirms that urban sustainability and partnerships are central to advancing inclusive development (Nabiyeva and Wheeler, 2024).

Analyzing SDG axes 11-12-17 involves observing how these goals influence each other. ‘The SDGs aim to impact all levels of society, reach across all sectors, embrace equity, inclusion, and universality, and operate in an ecosystem’ (Cerf, 2019, p. 1). The analysis of inclusive sustainability in the context of the Republic of Moldova is based on a relevant,

integrated approach, grounded in data and empirical evidence, which connects national progress indicators related to Sustainable Development Goals 11, 12, and 17 with the dynamics of Official Development Assistance flows.

The selection of SDG 11, SDG 12, and SDG 17 is justified by their strategic relevance for the Republic of Moldova and their convergence with the priority areas of intervention of Official Development Assistance. The objectives included in the National Strategy ‘European Moldova 2030’, the National Plan for the Implementation of SDGs, and the sectoral programs for local development are closely dependent on ODA investments, which finance projects in urban mobility, energy efficiency, climate risk management, and modernization of public services.

In view of testing the coherence of this triad covering social, environmental, and institutional inclusion, and showing that it is consistent with the SDG interlinkages and choice of specific instruments for assessing the inclusive sustainability, following Tinbergen’s model, the following research questions must find their answers:

Q1. How effectively does aligning ODA with inclusion and SDGs with sustainability advance Moldova’s progress toward inclusive sustainability?

Q2. What patterns emerge between ODA inflows and SDGs 11, 12, and 17 performances between 2016 and 2023?

Q3. Does assigning ODA as a lever for inclusion and the SDGs as a lever for sustainability lead to measurable progress in Moldova, and what evidence supports this?

Q4. How can Tinbergen’s two-objectives-two-instruments framework inform more coherent policy design in Moldova?

In Section 2, we conduct a bibliometric analysis of the literature on inclusive sustainability, examining how SDGs 11, 12, and 17 are conceptually and thematically connected. Section 3 substantiates the choice of the analyzed timeline. Section 4 shifts to an empirical analysis, correlating Moldova’s SDG performance on goals 11, 12, and 17 with its Official Development Assistance inflows to uncover patterns of alignment. Section 5 then employs Tinbergen’s two-objectives-two-instruments framework to interpret these results, linking the inclusion objective to ODA and the sustainability objective to domestic SDG performance. Taken together, these sections move from mapping the literature to quantitative findings and finally to a unifying theoretical model.

2. Literature review

– Bibliometric mapping of inclusive sustainability (SDGs 11/12/17)

The literature review combines a brief bibliometric mapping with a conceptual synthesis. Its aim is to identify how the term inclusive sustainability appears across research on SDGs 11, 12, and 17, and to highlight the gap that this study addresses – namely, the lack of empirical evidence linking ODA with inclusive sustainability outcomes.

In order to achieve the objectives of the paper, we conducted an exploratory bibliometric mapping to identify how inclusive sustainability is defined and analyzed in correlation with the three SDGs representative of the research topic in the specialized literature.

Though the terms ‘sustainability’ or ‘sustainable’ first appeared in the 20th century, the equivalent concepts have been used for centuries. The idea of sustainable development has a long history in China, and the concept can be traced back to the core idea of Chinese classical philosophy – ‘天人合一’ (Heaven and people in one) (Shi *et al.*, 2019, p. 4).

The concept of sustainability is complex due to its cross-disciplinary character, the emphasis it places on the impacts of management decisions, its multidimensionality, and the requirement to take future generations’ needs into account (Beccarello and Foggia, 2022, p. 1) and encompasses three dimensions: environmental protection, economic profitability, and social responsibility. The word sustainability comes from the Latin verb *sustinēre*, that means ‘to maintain, sustain, support, endure’, made from the roots *sub*, ‘up from below’, and *tenēre*, ‘to hold’.

Sustainability generally refers to systems, behaviors, and activities designed to maintain a particular entity or resource (Ciccarelli *et al.*, 2022). Because sustainability is a conceptual construct to be applied to real systems with a material existence, it is assumed that they are open systems, and therefore exchange matter, energy, and information with their surroundings, exchanges that can be represented as input (inputs) and output (products) variables (Ruggerio, 2021, p. 5).

The concept of sustainability is often associated with the concept of sustainable development, and the two terms are sometimes used interchangeably.

The role of the SDGs in guiding the implementation of sustainability in cities has been widely discussed in academia since their adoption in the year 2015 (Krellenberg *et al.*, 2019, p. 2).

The 2030 Agenda for Sustainable Development, adopted in 2015, represents a universal, comprehensive, specific, and complex framework with 17 Sustainable Development Goals (SDGs) and 169 targets. Implementation of SDGs is primarily a governance competence – the ability of institutions and actors to coordinate, design, implement, and monitor integrated policies across multiple scales. The concept of sustainability is deeply intertwined with the SDGs, particularly Goals 11, 12, and 17.

Sustainable Development Goals 11, 12, and 17 cannot be analyzed in isolation but must be understood as interdependent parts of a complex ecosystem of sustainable development. They reflect complementary dimensions of sustainability – urban, economic, and global – and provide a strategic framework for implementing structural transformations. Achieving sustainability indicators is only possible through an integrated and complex approach based on multilateral cooperation and the equitable distribution of responsibilities. Challenges associated with SDGs can be overcome by strengthening the science, technology, and innovation ecosystem, as it comprises of the production, dissemination, and use of knowledge and can offer possible solutions to address the trade-offs that the systemic nature of the SDGs presents (Chongtham *et al.*, 2024, p. 415).

SDG 11, ‘Sustainable Cities and Communities’, aims to ‘ensure inclusive, safe, resilient, sustainable urban and human settlements’ by removing slum-like situations, providing inexpensive transit solutions, decreasing urban sprawl, enhancing urban governance involvement, improving the protection of cultural assets, addressing urban resilience and climate change issues, improving urban management (pollution and waste management), ensuring access for all to secure public places and enhancing urban management through improved urban rules and regulations (Franco and Abe, 2020).

Figure 1 presents the key terms and groups used (urban sustainability, inclusive urbanization, equity in sustainability transitions, and inclusive cities), indicating that analysis of the evolution of the literature shows that the relationship between inclusive sustainability and SDG 11 has become increasingly complex and interdisciplinary, moving from conceptual foundations to applied assessments of urban policies and, more recently, to the implications of digitalization and smart cities for inclusion.

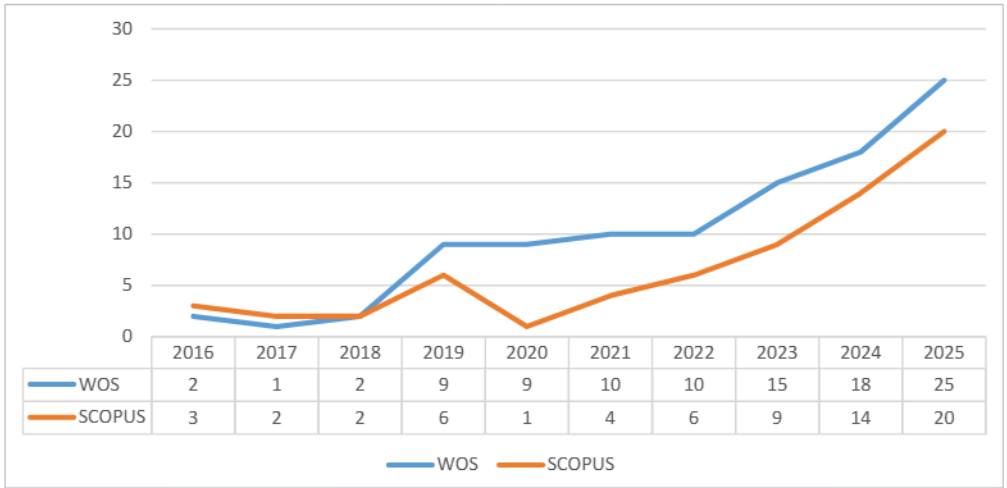


Figure 1: Evolutionary analysis of articles published in Web of Science Core Collection and SCOPUS for: inclusive sustainability and SDG 11

Source: Authors, data processed using WoS and SCOPUS

Since 2016, interest in studying the relationship between inclusive sustainability and SDG 11 has evolved significantly, addressing various dimensions of how inclusive sustainability principles can be integrated into urban governance. An important observation emerging from the dataset is that the exact expression ‘inclusive sustainability’ is not directly indexed in SCOPUS. Instead, publications cluster around related terms such as: urban sustainability (Hansson *et al.*, 2019; Shahmohammad *et al.*, 2024; Asma, 2025; Özeydin *et al.*, 2025; Owojori, 2025), sustainable urbanization (Wendling *et al.*, 2018), inclusive urbanization (Pérez del Hoyo *et al.*, 2021; Sádaba *et al.*, 2024; Stafford *et al.*, 2024), equity in sustainability transitions (Bova, 2020; Roszkowska *et al.*, 2025), inclusive cities

(Bhattacharya *et al.*, 2016a; Orkpeh and Adedire, 2024; Sádaba *et al.*, 2024). These terminological variations capture the broader intersection of inclusivity and sustainability in urban contexts (SDG 11) and demonstrate the importance of iterative keyword strategies and qualitative interpretation to complement quantitative bibliometric mapping.

Initially, between 2016 and 2020, in Web of Science Core Collection, studies focused on conceptual aspects, analyzing how inclusion complements sustainability, based on the economic–social–environmental triad (Bhattacharya *et al.*, 2016b; Koch and Krellenberg, 2018; Arslan *et al.*, 2017) and between 2020 and 2023, research has shown that in order to achieve SDG 11 indicators, it is necessary to adopt and implement policy models that ensure social equity, equal access to resources, and democratic participation in urban planning processes, addressing applied and interdisciplinary dimensions (Bartniczak and Raszowski, 2022; Mycoo and Bharath, 2021; Teklemariam, 2022). While all SDGs focus substantially on the link between two of the three criteria, SDG 11 covers all three elements, and SDG 17 takes relational issues to an operational level (Gupta and Vegelin, 2016).

Starting from 2023, research has expanded to include the analysis of the relationship between technologies and smart cities, examining whether the implementation of digitization and smart solutions contributes to inclusive urban sustainability or, on the contrary, creates new forms of digital or social exclusion (Staniewska *et al.*, 2023; Chandran *et al.*, 2025; Filho *et al.*, 2024; Shahmohammad *et al.*, 2024; Sharma *et al.*, 2025).

Figure 2 analyzes the evolution of literature on the relationship between inclusive sustainability and SDG 12, showing that the field is still emerging, with a limited number of papers and a predominant focus on circular economy paradigms, global resource flows,

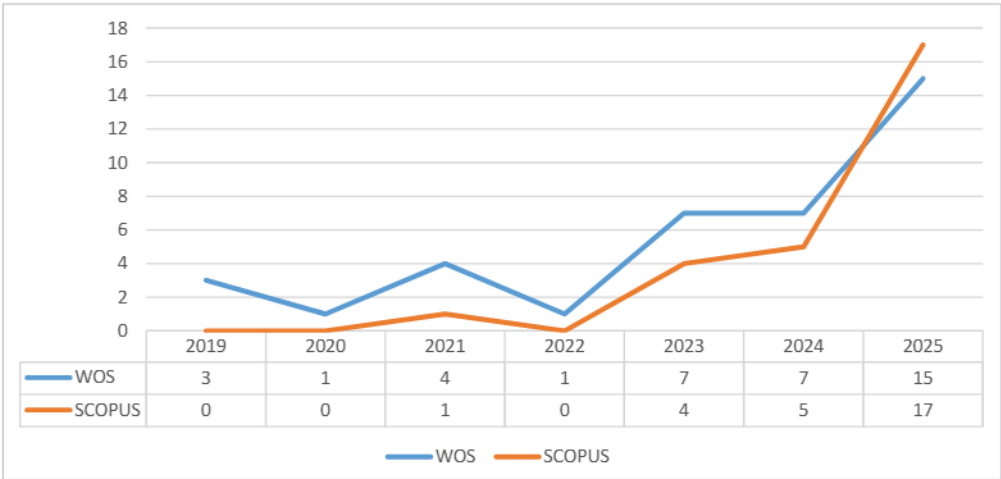


Figure 2: Evolutionary analysis of articles published in Web of Science Core Collection and SCOPUS for: inclusive sustainability and SDG 12

Source: Authors, data processed using WoS and SCOPUS

and persistent inequalities in access to technologies and responsible consumption practices. We believe that SDG 12 is a key point in understanding how inclusion can be integrated into the transition to responsible consumption and production, being a critical benchmark both for assessing the impact of ODA on national capacity to develop and implement sustainable policies and programs, and for formulating data- and evidence-based interventions that support equity, accountability, and resilience in resource management.

Regarding the study of the relationship between inclusive sustainability and SDG 12, the number of papers is considerably reduced, with 2019 as the reference year for indexing the articles in WoS.

The analysis of Sustainable Development Goal 12, ‘Ensure Responsible Consumption and Production’, is related to the institutionalization and analysis of circular economy paradigms (KaoDui and Kongkuah, 2025; Udendhran *et al.*, 2025; Raman *et al.*, 2025), the exploration of global patterns of material and energy flows (McDonnell *et al.*, 2020; Schwanitz *et al.*, 2024), and the persistent inequalities in access to resources and sustainable technologies (Shakoor and Ahmed, 2023), and inclusivity in the economy (Krysovaty *et al.*, 2024). Reducing these inequalities requires holistic and inclusive approaches (Van Niekerk, 2020) that promote coherent policies (Raman *et al.*, 2024) designed to advance equitable access and interactive public participation that supports true collaboration and empowerment (Geekiyana *et al.*, 2021), responsible consumption, and ensure a balance between economic growth and responsible environmental management and ecological limits.

Figure 3 highlights that the literature on inclusive sustainability in relation to SDG 17 has predominantly focused on the analysis of multi-stakeholder partnerships and the strengthening of institutional capacities and international cooperation mechanisms, while

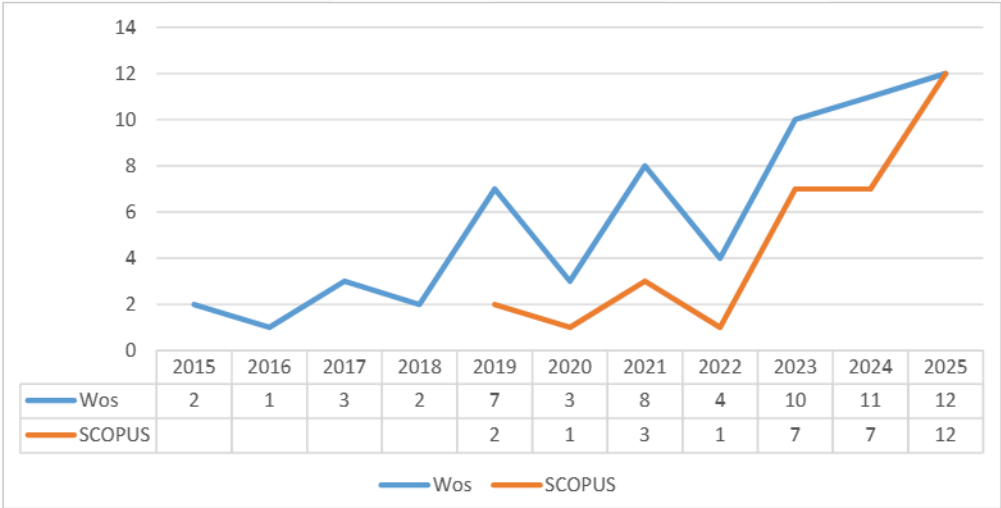


Figure 3: Evolutionary analysis of articles published in Web of Science Core Collection and SCOPUS for inclusive sustainability and SDG 17

Source: Authors, data processed using WoS and SCOPUS

also emphasizing the importance of ODA in reducing resource disparities and operationalizing sustainable development goals. This evolving thematic distribution confirms the importance of SDG 17 as a pillar of inclusive sustainability, providing the necessary framework for coordinating the interdependencies between the economic, social, and environmental dimensions and for supporting the implementation of coherent policies tailored to national needs.

As previous analyses show, inclusive sustainability transcends ‘conventional’ sustainability, emphasizing equity, participation, and justice from an economic, social, and environmental perspective. By regulating the Sustainable Development Goal 17, ‘Partnerships for the Goals’, the UN considers it essential to operationalize this three-dimensional vision, emphasizing the importance of cooperation among multiple stakeholders and institutional strengthening. SDG 17 stands for: a revitalization of global aid as a catalyst for progress – a condition that relies heavily on large (and continuous) movements of resources from higher-income countries to least-economically-advantaged ones (Prydz, 2023).

Inclusive sustainability requires systemic thinking, with environmental goals interconnected with social and economic goals, which SDG 17 can help to coordinate (Iacobuță *et al.*, 2024). Inclusive sustainability initiatives under SDG 17 are more effective when they integrate partnerships with multiple stakeholders from different regions – across governments, private sector, non-government organizations, civil society, and academia (Stott and Murphy, 2020; Sondermann and Ulbert, 2021), develop relational capacity (Breuer *et al.*, 2019; Sadic *et al.*, 2024; Horan, 2022a), build trust and responsibility (Cruz, 2023; Horan, 2022b), and adapt to local contexts.

The exploratory bibliometric analysis conducted on the three sustainable development goals – SDG 11, SDG 12, and SDG 17 – highlights that inclusive sustainability is an expanding field, defined by the gradual consolidation of an interdisciplinary perspective that connects urban processes, transitions to responsible consumption and production, and models of international cooperation. At the same time, the bibliometric analysis reveals the thematic fragmentation and diversity of conceptual tools used to address inclusive sustainability, which led us to apply Tinbergen’s model to create a framework through which the multiple objectives of inclusive sustainability can be coherently correlated with appropriate and distinct policy instruments, indispensable for the simultaneous operation of urban transformations, transitions to responsible consumption, and the consolidation of global partnerships.

Having mapped the fragmentation and convergence of inclusive sustainability in SDG 11/12/17 literature, we now turn to an empirical test of how these goals align with official development assistance in Moldova.

3. Selected timeline

The main sources of financing for SDGs fall into four major categories, with complementary mechanisms: domestic resources (Mawdsley, 2011, p. 193), Official Development Assistance (OECD, 2023, p. 19), private investment and financial markets (Arora and Sarker, 2023, p. 11), and multilateral funds and international financial institutions (e.g., World Bank, International Monetary Fund, Green Climate Fund).

Since its official adoption by the OECD Development Assistance Committee (DAC) in 1969, the evolving definition of ODA reflects progressively conceptual and methodological changes over time, which have substantially influenced the criteria, frameworks, and approaches used in assessing its impact.

Table 1: Chronological evolution of the ODA definition

Period	Definitional Milestone	Reform/ Change/ Significance
1969	OECD Development Assistance Committee (DAC): concessional financial flows from official sources, intended to promote economic development and welfare in developing countries.	First formal definition of Official Development Assistance (ODA)
1972	The definition is updated by introducing the rule of a subsidy element of at least 25%, calculated based on a discount rate of 10%.	A clear distinction was made between concessional loans (accepted as ODA) and commercial loans.
1980s–1990s	The definition of ODA is being extended to include administrative expenses, costs for refugees hosted in donor countries, peacekeeping components, and debt forgiveness.	The definition of ODA is gradually expanding.
2005	Paris Declaration on Aid Effectiveness: Reoriented ODA around ownership, alignment, harmonization among donors, managing for results, and mutual accountability.	ODA becomes a holistic instrument of global governance.
2014	OECD Development Assistance Committee (DAC): Overhauling the treatment of loans to better reflect their value and reporting ODA loans as ‘grant equivalents’ rather than measuring flows on a cash basis.	Starting with 2019, this approach became the standard reporting method onward.
2020–2022	The definition of ODA is extended with the inclusion of Security-Related items, debt relief, COVID-19 crisis assistance, and vaccine donations.	The changes reflect the impact of global events and the complexity of international aid.
2023–2024	Private Sector Instruments (PSI) – as equity investments, guarantees, and repayable grants – are included under ODA reporting	Shift in paradigm toward blended finance instruments and attracting private investment

Source: Authors

The importance of the Official Development Assistance (ODA) to developing countries has been strongly emphasized in the international community from the perspective of sustainable development and poverty alleviation (Choi, 2024, p. 2). Many countries

require Official Development Assistance as a critical mechanism to encourage economic growth and trade integration. ODA has a significant positive impact on economic growth in developing countries (Dan and Binh, 2019) but varies by sector and context.

ODA is not only a flow of capital for the implementation of social, economic, and environmental projects, but also a vector of participative and good governance that contributes to the strengthening of democratic institutions, the promotion of the rule of law, and the creation of inclusive decision-making processes.

The research refers to the data described below from 2016 to 2023, considering both the availability and the relevance of the interval as follows:

- 2016 – after the United Nations Sustainable Development Summit 2015 (September 25–27, 2015, New York);
- 2016 – On July 1, 2016, the EU-Moldova association agreement came into full force, following its provisional application from September 1, 2014 (European Council, 2025); and
- 2023 – most recent available data for ODA.

Based on our analysis, we aim to underline that although inclusion and sustainability are both widely studied, their explicit combination in the term ‘inclusive sustainability’ is relatively recent, both in academic and policy documents. This suggests that although conceptually fragmented, this domain is thematically convergent.

4. Methodology

The empirical analysis the research is opting for represents the first step in a broader, ongoing comparative ODA-SDG alignment analysis between the countries of the EU enlargement package. Therefore, the methodological design is meant to be exploratory, aiming at testing the analytical framework on Moldova as Europe’s most committed SDG candidate country and, in 2023, the fourth largest recipient of EU institutions’ bilateral official development assistance. The methodological paths (correlation analysis, Tinbergen’s two-instruments model, and SDG triad selection) are meant to validate whether this framework generates meaningful patterns before replicating it to other countries of the EU enlargement package and scaling it to a multi-country dataset.

4.1. Data sources and methods

This section describes the datasets, measures, and analytical steps employed to explore the relationship between ODA and selected SDGs in Moldova. The research aims to correlate Moldova’s domestic SDG Index and SDGs 11, 12, and 17 progress with ODA (Net official development assistance and official aid received (current US\$) – Moldova, as recipient country). Moldova is the fourth EU institutions’ bilateral ODA recipient (after Ukraine, Turkey and Serbia, in 2023), according to OECD reports (OECD, 2025), also the most committed to sustainable, fair and equitable human development, according to

Coherence Index of the European Commission (European Commission, 2023) and the SDGs (National Bureau of Statistics of Moldova, 2023).

4.1.1. Official Development Assistance (ODA)

Moldova's ODA figures were obtained from the World Bank's DT.ODA.ALLD.CD indicator ('Net official development assistance and official aid received, current US\$') (World Bank, 2025). The data from the World Bank provides annual values, with the values for the year 2023 being the latest released values; therefore, the 2016–2023 ODA amounts were analyzed. This data interval was selected for the above-mentioned reasons: 2016 being the first year measured after the SDG adoption in September 2015, the EU-Moldova association agreement came into full force in 2016, and 2023 being the last available data. Values were recorded in current U.S. dollars and are summarized in Table 2.

Table 2: Annual assessment of SDGs 11, 12, and 17 progress of Moldova

Year	Net ODA received (current US\$)	SDG 11 score	SDG 12 score	SDG 17 score
2016	262.05 million	90	78	71
2017	243.21 million	90	78	71
2018	259.72 million	90	76	73
2019	341.5 million	92	76	75
2020	524.26 million	91	76	78
2021	596.22 million	91	76	78
2022	884.50 million	92	76	78
2023	1,051.38 million	92	78	78

Source: ODA values are retrieved from the World Bank indicator DT.ODA.ALLD.CD (World Bank, 2025); SDG scores are gathered from the Sustainable Development Report 2025 (SDG Index) dataset (European Commission, 2025). Scores range from 0 (worst performance) to 100 (best performance).

4.1.2. SDGs goal scores

Goal scores for Sustainable Development Goals (SDG) 11 ('Sustainable cities and communities'), 12 ('Responsible consumption and production'), and 17 ('Partnerships for the goals') were taken from the SDG Index, a measurement of the total progress towards achieving the three researched SDGs. The score can be interpreted as a percentage of SDG achievement. This dataset contains yearly goal scores (0–100 scale) for every country from 2000 onward (European Commission, 2025). In the SDG Index sheet, Moldova's goal scores for 2016–2023 were extracted. The interval is kept for the same reason explained above. Nevertheless, even though the SDGs were only adopted at the end of 2015, their indicators are built on datasets that already existed long before 2015, so should the pilot case of Moldova prove the research goal and the retroactive scoring becomes sensitive for causality, the broad comparative analysis including Ukraine and Georgia can refer to data

starting from 2005 (before 2005 there is no data available for DT.ODA.ALLD.CD indicator for Ukraine).

Urbanization has increased the need for sustainable urban development by positioning smart cities as critical frameworks for addressing environmental, economic, and social challenges (Oyadeyi and Oyadeyi, 2025).

In line with our research, there are also other studies linking these insights to inclusive sustainability research, thus supporting that achieving the SDGs requires both robust local mechanisms of inclusion and broader transnational cooperation to ensure equitable opportunities, resource mobilization, and shared accountability (Peña-Acuña *et al.*, 2025).

Table 3: Annual assessment of SDG progress of Moldova

Year	SDG Index
2016	77.65
2017	77.83
2018	77.88
2019	78.20
2020	78.38
2021	79.19
2022	79.48
2023	78.81

Source: SDG Index values are retrieved from the European Commission's Composite Indicators & Scoreboards Explorer (European Commission, 2025)

All in all, the current research refers to a sample size of 8 years (2016–2023), with data collected from the two sources mentioned above (World Bank, European Commission SDG Index), the rationale behind the time frame being data completeness and policy relevance of the post-EU association agreement period.

4.2. Empirical correlation analysis (ODA vs. SDGs)

Pearson correlation coefficients were computed between annual ODA (US\$) and each SDG score. Given the small sample size, correlations were interpreted as exploratory. Where assumptions of linearity may not fully hold, results are presented descriptively, and Spearman rank coefficients were cross-checked for robustness (shown in Table 4).

Building on the bibliometric review, this section examines the empirical relationship between Moldova’s SDG performance (goals 11, 12, 17) and its Official Development Assistance flows.

To correlate ODA with SDG goal scores, the ODA amounts (US\$) for 2016–2023 were matched with the corresponding SDG goal scores. Pearson’s correlation coefficient was calculated for each goal.

Following a similar reasoning, in the context of the Official Development Assistance (ODA), there is also research underscoring how enhanced domestic revenue mobilization

through effective tax governance can reduce aid dependency, ensuring that inclusive sustainability is grounded in both local fiscal autonomy and international cooperation (e.g. it demonstrates that the strictness of transfer pricing regulations within EU member states has a significant and positive correlation with progress toward the SDGs (Ignat and Tache, 2023)).

Table 4: Correlation between ODA and SDGs score (2016–2023)

SDG goal	Correlation between ODA and SDGs score (2016–2023)	Interpretation
SDG 11 – Sustainable cities and communities	$r = 0.76$ $\rho = 0.82$	There is a strong positive correlation (both linear and monotonic) between ODA received and Moldova's SDG 11 score. The Pearson coefficient ($r = 0.83$) indicates a strong positive linear relationship between ODA and Moldova's SDG Index score over 2016–2023. The Spearman coefficient ($\rho = 0.86$) similarly shows a strong positive monotonic association, confirming that higher ODA years tend to align consistently with higher SDG performance. The slightly higher Spearman value reflects the robustness of the trend even when accounting for minor nonlinear fluctuations such as the 2023 SDG index dip. As ODA increased from 2016 to 2023, the SDG 11 score also rose slightly (from ~89.90 to 92.14). The correlation suggests that development assistance may have improved urban infrastructure and housing, although four observations are insufficient to establish causality.
SDG 12 – Responsible consumption and production	$r = -0.004$ $\rho = -0.17$	The correlation is extremely close to zero, slightly negative. Pearson's r (-0.004) indicates no linear relationship, and Spearman's ρ (-0.17) confirms that there is no monotonic association across the ranked data. The variables, therefore, appear statistically independent over the observed period. Although ODA increased almost fivefold between 2016 and 2023, Moldova's SDG 12 score drifted slightly downward in this period, and only in 2023 went back to the initial value corresponding to 2016 (from 78.03 to 76.33 and then back to 77.80). This suggests that improvements in sustainable consumption and production were not directly tied to aid inflows; domestic policies and structural economic factors may matter more.
SDG 17 – Partnerships for the goals	$r = 0.81$ $\rho = 0.89$	ODA has a very strong and consistent positive correlation with the SDG 17 score. The Pearson coefficient ($r = 0.81$) shows a strong positive linear association between the variables, suggesting that increases in one are accompanied by proportional increases in the other. The Spearman coefficient ($\rho = 0.89$) is even higher, indicating an almost perfectly monotonic relationship. This implies that the variables move together consistently in rank order, even if the year-to-year increments are not strictly linear. Moldova's SDG 17 score improved from 70.64 in 2016 to 78.17 in 2023, while ODA increased rapidly. This alignment may reflect that ODA often comes with technical assistance, policy dialogue, and regional partnerships, which directly contribute to SDG 17 indicators such as capacity-building and multi-stakeholder partnerships.

Source: Authors, based on data shown in Table 3

To support the model validation, the positive Moldova result for SDG 17, where ODA strongly correlates with partnerships, matches other research that, even though they show general patterns and not specific SDG analysis, it finds that SDG scores are crucial in tailoring ODA and notes that interactions between SDGs differ by country. Moreover, some SDGs (e.g., governance, partnerships) align well with aid effectiveness (Choi, 2024).

On the same line of confirming the findings for SDG 17 (positive ODA link), Ezako (2024) shows that ODA alone may harm development, but combined with governance it helps. The author also puts a strong emphasis on SDG 16 and SDG 17 interactions and notes that consumption, production and emissions links are complex and can be negative – which is indirectly consistent with the negative correlation with SDG 12 from Table 4.

Also supporting the positive ODA–SDG 17 correlation in Moldova, Mawdsley (2018) argues that ODA is shifting role and it is now more about leveraging partnerships and finance (Goal 17). Last but not least, Nomura (2023) also confirms that partnerships and international cooperation remained strong, consistent with the SDG 17 finding in Table 4. And, more importantly, the author shows that ODA allocation shifted toward health, while sectors like energy, water, and environment fell, which indirectly echoes Moldova’s negative SDG 12 link, since sustainable consumption and production goals often lost priority.

In support of the positive ODA–SDG 11 relationship in Table 4, although not Moldova-specific, Koch (2018) shows that external support can shape urban outcomes, but measurement differs across contexts. This emphasizes that urban SDG progress depends heavily on local or national contexts.

These observed patterns of SDG-ODA correlation suggest distinct roles for ODA versus domestic SDG efforts; in section 5 we interpret these findings through Tinbergen’s two-objectives–two-instruments framework.

4.3. Limitations and further work

Given the 8-year deliberate limitation set by the research, for the reasons outlined above, the statistical significance is exploratory and should be interpreted cautiously; future studies could apply regression or time-series models as data extend. Therefore, if this pilot case on Moldova, intentionally set to 2016–2023, confirms the validity of the research design and the retroactive scoring proves robust enough for causal pattern analysis, the broader comparative study – including Ukraine and Georgia – may be extended back to 2005 (the earliest year for which ODA data, specifically the DT.ODA.ALLD.CD indicator, are available for Ukraine).

Having established the strength of associations between aid and certain SDGs and emphasized the limitations of the analysis, we now explore a theoretical model to explain these relationships.

5. Application of Tinbergen’s two-objective model

Applied initially to economic policies (i.e., monetary and fiscal policies), we adapted Tinbergen’s Model to sustainability and inclusion as a framework that links each independent objective to at least one specific, independent policy instrument.

Table 5: Tinbergen’s model applied to two policy objectives (inclusion and sustainability) and two instruments (ODA and SDG targets)

Objective	Policy instrument	Mechanisms
Sustainability	SDG 11, SDG 12, SDG 17 Targets	Policy and Regulatory Mechanisms (National SDG strategies, Regulations) Institutional Mechanisms (Dedicated SDG units, Inter-ministerial committees, Local government engagement) Financing Mechanisms (Domestic public finance, Official Development Assistance (ODA), Bilateral and multilateral aid, Public-Private Partnerships) Partnerships and Multi-Stakeholder Engagement (United Nations and international organizations, Private sector engagement, Civil society and community participation) Monitoring, Evaluation, and Reporting (SDG indicators, National statistical systems, Voluntary National Reviews) Education and Capacity Building (Formal education integration, Training programs)
Inclusion	ODA	Bilateral Aid (Grants, Concessional Loans, Technical Assistance) Multilateral Aid (Contributions to International Organizations, Pooled Funding) Project-Based Assistance Program-Based Assistance Humanitarian Assistance Private Sector Engagement

Source: Authors

The below graphs show how Moldova’s net ODA received (exogenous variable) relates to each SDG score (endogenous variable) for the 2016–2023 period:

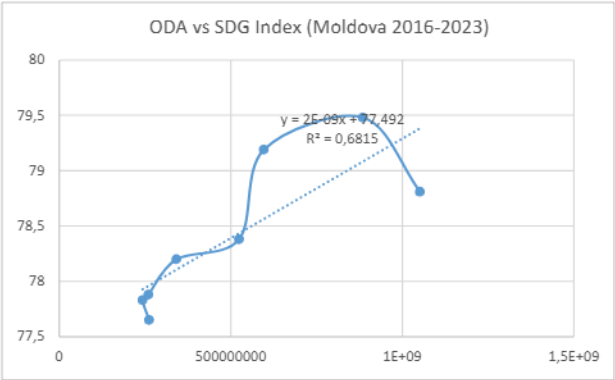


Figure 4: Correlation between ODA and SDG Index

Source: Authors, data extracted from World Bank indicator DT.ODA.ALLD.CD and SDG Index

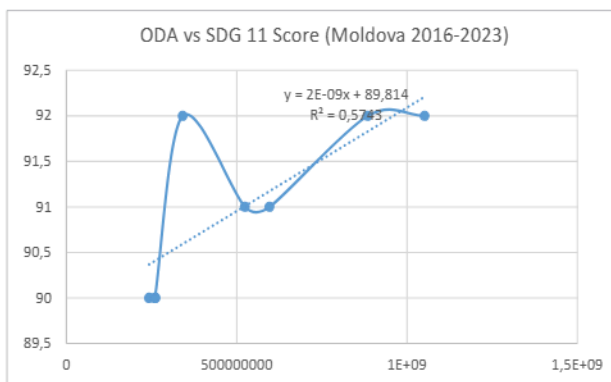


Figure 5: Correlation between ODA and SDG 11 score

Source: Authors, data extracted from World Bank indicator DT.ODA.ALLD.CD and SDG Index

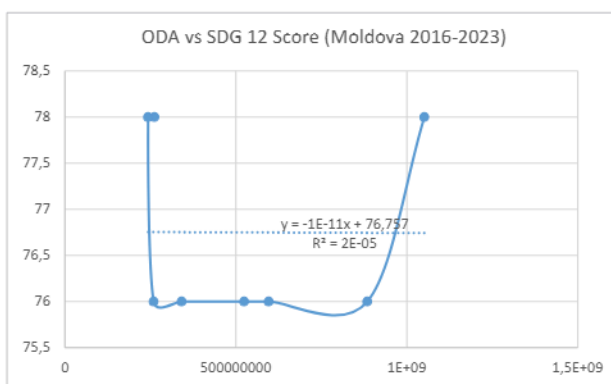


Figure 6: Correlation between ODA and SDG 12 score

Source: Authors, data extracted from World Bank indicator DT.ODA.ALLD.CD and SDG Index

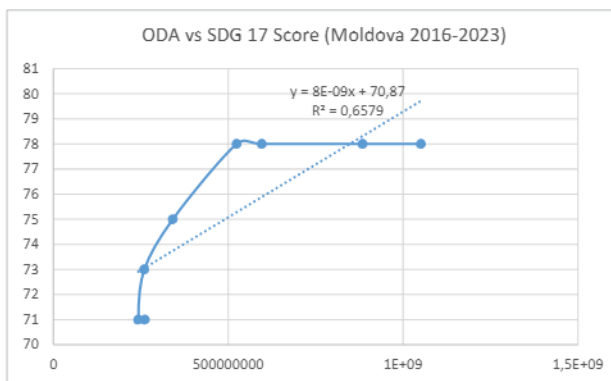


Figure 7: Correlation between ODA and SDG 17 score

Source: Authors, data extracted from World Bank indicator DT.ODA.ALLD.CD and SDG Index

These scatter plots include dashed regression lines. It can be seen that the ODA increase from 2016 to 2023 corresponds to a noticeable upward trend in SDG Index, SDG 11, and SDG 17 scores, while SDG 12 shows little change.

6. Discussion

6.1. ODA dynamics and SDG alignment

The reforms adopted by Moldova after gaining independence in 1991 involved major legal and institutional reforms and the establishment of independent and democratic political institutions in accordance with European and international standards. Moldova's receipt of ODA is influenced by economic and social development (Francisco and Moreira, 2022), poverty eradication, geopolitical and strategic considerations (Stiller, 2018), and preparation for EU accession.

- ODA trends: World Bank data show that Moldova's net official development assistance increased substantially after 2016, rising from about US\$262.05 million in 2016 to US\$596.2 million in 2021 and jumping to US\$1,051.4 million in 2023. The steep rise in 2023 was likely driven by donor support to help Moldova manage the economic and social impacts of the war in neighboring Ukraine and energy-price shocks.
- SDG 11 performance: Moldova has consistently high SDG 11 scores (around 92 points). The slight improvement alongside rising ODA suggests that aid-funded projects, such as urban infrastructure upgrades, housing programs, and improvements in disaster-resilient planning, may support sustainable cities. However, the correlation does not necessarily imply causation; local government actions and EU neighborhood assistance also play roles.
- SDG 12 performance: Despite higher ODA, Moldova's SDG 12 scores remained almost flat and even dipped in 2018. SDG 12 indicators measure sustainable consumption, waste management, and resource efficiency; these areas may not be the focus of ODA projects. Structural challenges, limited industrial diversification, and consumer-behavior patterns could explain the weak link between aid inflows and SDG 12 progress.
- SDG 17 performance: The positive correlation between ODA and SDG 17 likely reflects the role of aid in fostering partnerships and capacity-building. ODA often includes technical assistance, training, and regional cooperation initiatives. These contribute directly to SDG 17 indicators such as international collaboration, trade facilitation, and capacity development, explaining the observed improvement in Moldova's SDG 17 score.

6.2. Policy and practitioner implications

SDG 11 is strategically relevant for the Republic of Moldova, which is undergoing a continuous process of urban transformation due to internal migration and urbanization concentrated in Chişinău, Bălţi, and Cahul, as well as administrative decentralization. In

this context, the paper aims to conduct a systemic analysis of building urban resilience and reducing territorial inequalities by correlating ODA support with adopted local development public policies. Through ODA, numerous projects have targeted the development of sustainable urban infrastructure, waste management, and green mobility. Initiatives such as ‘EU4Moldova: Focal Regions’, ‘Mayors for Economic Growth’, and ‘Green City Lab Chişinău’ contribute to the implementation of participatory local governance practices and the improvement of urban quality of life (European Union, 2023).

SDG 12 promotes the transition to sustainable consumption and production patterns and provides the conceptual and analytical framework for assessing institutional capacity to promote sustainable and responsible economic practices. Although the Republic of Moldova has begun implementing circular economy policies (Waste Management Strategy 2023-2030, National Environmental Strategy), results are limited due to limited institutional capacity and technology. In this context, ODA plays a catalytic role, contributing through programs supported by GIZ, UNDP, the World Bank, and the European Union in areas such as waste management, sustainable agriculture, and energy efficiency to Moldova’s transformation into a circular and competitive economy.

The Republic of Moldova is one of the largest recipients of development assistance in Eastern Europe (OECD, 2024), making SDG 17 a key objective for understanding how international partnerships and external resources support national development and contribute to progress in implementing the SDGs.

The interaction between SDGs can be unidirectional, bidirectional, circular, or multiple (ICSU, 2017, p. 26), with progress on one goal facilitating or, sometimes, hindering progress on another. There is a synergy between SDG 11 and SDG 12: improving responsible consumption and production can facilitate more sustainable cities; in turn, sustainable cities provide the infrastructure and conditions for more responsible consumption/production.

The implementation of SDG 11 in the Republic of Moldova has led to the adoption of public policies and internal strategic documents, such as the National Regional Development Strategy 2022–2028, approved by Government Decision no. 40/2022, which sets out strategic directions for the development of urban centers, the regeneration of public spaces, and increasing the population’s access to quality public services, The National Program for the Development of Growth Pole Cities 2021–2027, established by Government Decision no. 916/2020, has directed public interventions and ODA investments towards the modernization of cities with regional polarization potential. These instruments are integrated into the national planning defined by the ‘European Moldova 2030’ Strategy (Law no. 315/2022), which identifies sustainable urban development as a key element of European convergence.

The main public policies aimed at transitioning to a sustainable economic model aligned with European standards are included in the 2024–2030 Environmental Strategy, which sets clear objectives for reducing waste generation, increasing resource efficiency, and promoting the circular economy, the Waste Management Strategy 2013–2027,

adopted by Government Decision no. 248/2013, which regulates the operational basis for the development of waste collection, recycling, and treatment infrastructure, representing one of the main instruments for implementing SDG 12 and the Green Economy Promotion Program 2018–2020.

The implementation of SDG 17 in the Republic of Moldova is anchored in the strengthening of internal coordination, monitoring, and international cooperation mechanisms. The national framework for monitoring Agenda 2030, approved by Government Decision no. 953/2022, National Development Plan 2024–2026, and the ‘European Moldova 2030’ Strategy (Law no. 315/2022) explicitly positions international partnerships – financial, technical, and political – as the driving force behind the implementation of reforms. Analyzing these documents, we find that ODA is not simply a financial flow, but an instrument for institutional modernization, expertise transfer, and governance capacity building, and SDG 17 is the framework that brings together domestic political will, international support, and the reform processes necessary for EU accession.

7. Limitations and further work

- Data availability: ODA figures for 2024 are not yet published by the World Bank, so correlation analysis could not include data for this year. Future studies should update the analysis when new ODA data becomes available.
- Small sample size: Correlation was calculated using only eight yearly observations (2016–2023). While the results hint at relationships between aid and SDG performance, they are not statistically robust. More years of data or higher-frequency (quarterly) data would improve reliability.
- Causality: Correlation does not imply causation. SDG progress depends on numerous factors – domestic policies, economic growth, EU integration, remittances, and regional dynamics. Understanding causal pathways would require detailed project-level analysis and econometric modelling.

There are no reliable open-source statistics that break down Moldova’s net ODA receipts by sector (e.g., urban infrastructure, waste management, energy efficiency, or partnership-focused programs) for 2016–2025. The main public databases (OECD’s CRS and IATI’s datastore) either require complex API queries that we couldn’t execute in this environment or restrict direct access, and Moldova’s government data portal doesn’t provide sector-specific ODA amounts.

However, official development banks and EU institutions publish detailed project summaries. These reveal some major sector-specific ODA flows relevant to SDG 11, 12, and 17 in Moldova during this period:

- Municipal solidwaste management (SDG 11/12) – The EBRD’s ‘Chişinău Solid Waste’ project (2020) comprises a sub-sovereign loan of up to €9 million for the municipal company Regia Autosalubritate, co-financed by an EIB loan of another

€9 million and a €5 million grant from the Eastern Europe Energy Efficiency and Environmental Partnership (E5P). The project funds the closure and rehabilitation of sections of the Tintareni landfill, improvements to access roads, renewal of vehicle fleets, and investment in a waste-sorting plant (EBRD, 2025).

- National solid-waste strategy (SDG 11/12) – In 2022, the EBRD approved a sovereign loan of up to €25 million to the Republic of Moldova to build integrated solid-waste management systems across several waste-management zones. The EIB is co-financing the program with another €25 million loan, and E5P is contributing grants (up to €5.6 million for the first tranche). The project aims to establish waste-management systems in line with EU environmental standards, and introduces public-service contracts to ensure cost recovery and transparent governance (EBRD, 2025).
- Urban energy efficiency and healthcare (SDG 11/17) – In July 2025 the EIB’s development arm announced that it would lend Moldova over €244 million for energy and healthcare upgrades. This package includes €143.5 million for district-heating upgrades in Chişinău, replacing vertical heating systems with horizontal pipelines and installing individual thermal substations – measures expected to cut energy use by 25% and reduce greenhouse-gas emissions by 7% (NeighboursEast, 2025). A separate €101 million loan will fund the construction of a regional hospital in Cahul, improving healthcare services for about 300,000 residents (NeighboursEast, 2025). Both loans are co-financed with other donors and accompanied by EU/E5P grants (NeighboursEast, 2025), demonstrating partnership-based financing consistent with SDG 17.

Although these examples are not a comprehensive sectoral breakdown of all ODA received by Moldova, they illustrate how recent official development assistance has targeted urban services, waste-management infrastructure, energy efficiency, and multi-donor partnerships – core areas under SDGs 11, 12, and 17.

A more systematic assessment of these interventions – similar to the multidimensional SDG-alignment and governance framework proposed in the STARHAUS project – would provide a clearer understanding of how such investments contribute to socio-ecological transition and multi-actor partnerships (Ratnayake *et al.*, 2025).

8. Conclusion and future research

Moldova’s surge in ODA since 2019 has coincided with improvements in SDG 11 (sustainable cities) and SDG 17 (partnerships), while progress on SDG 12 remained flat. These findings suggest that aid programs may be supporting urban and partnership-related goals more effectively than sustainable consumption initiatives. Additional research and data will be needed to draw stronger conclusions and to monitor trends as new ODA data becomes available.

In summary, the analysis used World Bank data to compile Moldova’s net official development assistance (ODA) for 2016–2023 and cross-referenced it with SDGs 11, 12, and

17 scores from the Sustainable Development Report 2025 (SDG Index). ODA jumped markedly from US\$262.05 million in 2016 to US\$1,051.4 million in 2023, while SDG 11 and SDG 17 scores improved gradually over the same period. SDG 12 remained relatively flat, suggesting that aid did not significantly influence responsible consumption and production.

The research calculates Pearson correlation coefficients using the eight-year span, finding a strong positive relationship between ODA and SDG 11 ($r \approx 0.75$) and SDG 17 ($r \approx 0.81$), but a slightly negative correlation with SDG 12 ($r \approx -0.004$). These results hint that aid has supported urban infrastructure and partnership-building more than sustainable consumption initiatives, although the limited sample prevents definitive conclusions. The document cautions that correlations do not imply causation and notes the absence of a larger ODA data interval, urging further research once the research is deepened.

Nevertheless, the research suggests that TOSSD (TOSSD, 2025) could be used for future research, though the data is only available for 2019–2023, and the fact that it is split into 10 receiving sectors could help better emphasize the support for Moldova’s sustainable development. As there is only a 5-year interval, the research could further use Lampert’s scenario analysis (Lempert *et al.*, 2006, pp. 514–528; Groves and Lempert, 2007; Lempert, 2013; Trutnevyte *et al.*, 2016) to help identify the trends so to better substantiate the continuation or rescission of funding decisions.

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