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Research article

Monitoring SDG localisation: an evidence-based approach to standardised monitoring frameworks

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Abstract

This article studies closeness between indicators that local governments use to monitor Sustainable Development Goal (SDG) implementation in their Voluntary Local Reviews (VLRs) and those included in the standardised set of indicators of the *European Handbook for SDG Voluntary Local Reviews*. To do so, it develops an index of 'indicator proximity' through a qualitative semantic comparison between 2354 indicators used in a sample of 29 VLRs and the 72 indicators included in the Handbook's standardised set. The index includes absolute and relative scores, taking into consideration size, comprehensiveness and diversity of the indicator sets included in the sample, as well as the methodological features of the Handbook's set. The index allows to identify the VLRs with higher or lower proximity to the indicators in the standardised set and the SDGs that elicit a higher or lower degree of closeness between standard metrics and indicators selected or defined by local governments. The output shows that VLRs and the Handbook have an overall significant degree of proximity; that variables such as local government type or size or the size of VLR indicator sets do not provide additional explanation for proximity; and that SDGs that can be monitored with locally accessible and affordable data elicit higher indicator proximity.

Key words: SDG localisation, Voluntary Local Review, Local and Regional governments, Strategic Planning, 2030 Agenda for Sustainable Development, Indicators

Introduction: indicator analysis and the Sustainable Development Goals

In 2015, the General Assembly of the United Nations (UN) approved the 2030 Agenda on Sustainable Development (United Nations General Assembly 2015, hereafter the '2030 Agenda'), the comprehensive policy framework that compels its signatory parties to achieve a set of 17 Sustainable Development Goals (SDGs) and their 169 targets by 2030. It is designed to undertake 'bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path' through an enabling environment to 'realize the human rights of all' so that 'no one will be left behind' (United Nations General Assembly 2015: 1). More than 7 years into the SDG era, local and regional governments (LRGs) have become increasingly important actors in their achievement. The information and data they provide have grown from sporadic footnotes in national SDG reports to linchpins of a bottom-up process of policy adaptation to the 2030 Agenda—especially in the form of Voluntary Local Reviews (VLRs), policy and strategy documents with which LRGs have begun reporting on SDG localisation.[1]

1 Localisation is understood here as 'the process of defining, implementing and monitoring strategies at the local level for achieving global, national, and sub-national sustainable development goals and targets' (UCLG 2019: 21).

LRGs' contribution to monitoring the SDGs has been essential to appreciate the framework's impact on territory and communities. If compared to intergovernmental implementation, however, the mismatch between the SDGs' global monitoring framework and the information that LRGs are able to collect has made 'adequate data… an ongoing problem for the SDGs' (Klopp and Petretta 2017: 96). SDG monitoring relies on concepts and metrics designed for the global level and not always adaptable to the local level. Despite these issues, over the last few years, LRGs have significantly improved their monitoring capacities. Local work on data, indicators and target compliance has become an increasingly common feature of many VLRs.

How do VLRs measure and monitor SDG implementation? There are no established results on this matter. Preliminary studies on a reduced sample of European VLRs show a significant degree of variation: as of early 2021, almost 96% of all indicators used in European VLRs were either originally designed by the institutions in charge of the review (52.8%) or extracted and adapted from national databases and methodologies (42.9%) (Ciambra 2021). This has led to a high degree of diversity, a heterogeneity that affects the comparability of LRGs' approaches to the SDGs, thus also reducing the replicability of good policy practices or mutual-learning opportunities.

Accordingly, several institutions have focused on the definition of more standardised sets of indicators that may provide more local authorities and policy-makers with a common framework for SDG monitoring and a crucial building block for local reviews to include more and better data. Standardised data toolkits could support LRGs with lower data-management capacities and contribute to a more systematised, time-series record of first-hand local data on the impact of the 2030 Agenda on local communities.

This article assesses what is the current balance between these two approaches—mixed monitoring metrics with a large variety of indicator sources vis-à-vis the opportunity to use a pre-set standardised toolkit—by analysing the proximity between the indicators used in a sample of VLRs and those selected in one of the standardised toolkits currently available in the SDG localisation policy community, namely the *European Handbook for SDG Voluntary Local Reviews* (hereinafter, the Handbook), developed by the European Commission's Joint Research Centre (Siragusa et al. 2022). How close are the metrics of a standardised set like the Handbook to the real-world practice of LRGs in Europe? What SDGs elicit higher or lower proximity between local practice and standard toolkits? These are the main research questions addressed in this article.

The 'The quest for a common monitoring approach and the Handbook' section defines the current landscape of SDG localisation monitoring. The 'Analytical design and methods' section defines the methods and techniques of the data analysis performed in the 'Indicator proximity and European VLRs' and 'Indicator proximity and the SDGs' sections, where a set of indicator proximity indexes are used to compare closeness between indicators in the Handbook and the sampled VLRs. The 'Conclusions' section summarises the main takeaways and conclusions of the conducted research.

The quest for a common monitoring approach and the Handbook

SDG localisation has been increasingly part of the academic conversation on international politics and the impact of global policy frameworks on local government. While it is undeniable that the SDGs, 'because many of the challenges they look to address, including climate change, life below water, and peace and justice, are truly international' (Jones and Comfort 2020: 2), there is growing acknowledgement of the significant impact that local policies, participation and communities can have on the achievement of the Goals (Tollin 2015; UNDG, UN-Habitat, UNDP, and GTF 2015; UCLG and GTF 2017; Deininger et al. 2019; OECD 2020; Bertozzi et al. 2021; Bilsky, Moreno, and Fernández Tortosa 2021; Martínez 2022; Ciambra, Stamos, and Siragusa 2023).

This focus has inevitably put the spotlight on the issue of measuring such impact and quantifying (or at least operationalising) both the contribution of local governments to the achievement of the SDGs and the degree of policy change and innovation that localisation is driving across territories and communities. SDG indicators more generally have been a contentious topic (Reyers et al. 2017; Bell and Morse 2018; Fukuda-Parr and McNeill 2019; Merry 2019; Kapto 2019), considering that defining a finite number of statistical measurements for a range of complex and transversal global issues requires 'the design of adequate data collection tools' while also the 'strengthening of the capacity of national statistical offices and systems' (Ordaz 2019: 141). In this regard, VLRs have been consistently seen as a valuable tool for local governments, not only to coordinate and integrate SDG localisation within their own local policy-making structures, venues and strategies (UN-Habitat and UCLG 2020; UN-ESCAP 2020; UN-Habitat and UCLG 2021; Narang Suri, Miraglia, and Ferrannini 2021; Ortiz-Moya and Reggiani 2023), but also as a way to improve or systematise localisation monitoring via local data, measurement, indicators and benchmarks. Research in this specific policy space—i.e. the intersection of monitoring frameworks, indicators and the VLRs as a bottom-up and co-owned localisation tool—is still fledgling. This article also aims to contribute to this conversation by comparing the methodological design and strategic underpinning of specific sets of 'standardised' localisation indicators with those adopted by a sample of European VLRs.

The lack of adequate local data or the technical and human resources to manage and use it for consistent, replicable policy monitoring has long been signalled as a key barrier for local governments to contribute to bottom-up SDG localisation (Klopp and Petretta 2017; UCLG and GTF 2020). Several international institutions have increasingly supported SDG localisation and partnered with LRGs in their efforts to monitor implementation from a truly local perspective. This has also included providing guidance on use and interpretation of data and improving statistical capacity.

In 2015, the Sustainable Development Solutions Network (SDSN) presented a set of 10 'criteria' as the basis for an effective global SDG monitoring framework, recommending that indicators be 'consensus-based, in line with international standards' (SDSN 2015: 18). Every year since 2016, in collaboration with the Bertelsmann Foundation, SDSN has also published a global report on SDG implementation based on its SDG Index—a set of 232 metrics to complement official UN statistics.[2] SDSN and Bertelsmann have adapted their methodology to specific local contexts, to provide monitoring toolkits tailored to relevant

2 The SDG Index data also feed a live online dashboard: https://dashboards.sdgindex.org/, accessed 03 September 2022. SDSN's library includes 4 regional reports and 10 localised reports at the subnational level: https://dashboards.sdgindex.org/downloads, accessed 03 September 2022..

localisation efforts. Since 2018, an institutional partnership led by the Bertelsmann Foundation has adapted the SDG Index toolkit and methodology to the German context. The resulting tool, *SDG-Indikatoren für Kommunen*, has served as the monitoring framework of reference for several VLRs developed by German municipalities (Assmann et al. 2018).

Since 2019, UN-Habitat has advocated, with the support of the UN Statistics Commission, the establishment of a 'single monitoring framework for the urban dimensions of the SDGs' (UN-Habitat 2022: 9). In July 2020, an Expert Group Meeting set up the process for the establishment of UN-Habitat's Global Urban Monitoring Framework (GUMF). The GUMF is currently being tested by several pilot cities within UN-Habitat's SDG Cities programme.[3] Similarly, in 2017, the United for Smart Sustainable Cities (U4SSC) initiative developed a set of 82 Key Performance Indicators (KPIs) to support cities and local governments in the self-assessment of their pace in the implementation of the SDGs (CBD et al. 2017).[4] U4SSC has been working with about 150 local governments to pilot their platform and test its KPIs.

Since 2018, the URBAN2030 project of the European Commission's Joint Research Centre (JRC) has worked for the establishment of an enabling environment for SDG localisation and implementation among European local governments. The project has developed several monitoring pilots with a host of European cities that volunteered to be part of the programme.[5] As one of the outputs of the project's work with local governments, in 2020, the JRC published the first edition of the Handbook (Siragusa et al. 2020),[6] a comprehensive study on SDG implementation monitoring in VLRs with key technical recommendations for local governments and a 71-indicator set with both experimental and adapted metrics to support local governments' data collection and management. The second edition—the one used to perform the comparative analysis of this article—was published in 2022, with 72 total indicators, 27 of which were newly designed. This adaptability to local data-management capacity is a specific feature of the Handbook's approach. It aims to explore a 'wide range of approaches, methods, data and indicators, output, scope, governance and links with local policies and strategies that have emerged from the VLRs' (Siragusa et al. 2022: 9) and recommend a toolkit that is accessible enough to be a viable option for any LRGs approaching a VLR, but also flexible enough to learn lessons from the actual way LRGs are using data and indicators on their localisation performance.

3 For more information on the programme: https://www.sdg-cities.org/, accessed 01 August 2022.
4 U4SSC is a UN initiative coordinated by the International Telegraphic Union (ITU), UN-Habitat and the UN's Economic Commission for Europe (UNECE). It builds on collaboration and support from various international stakeholders in the UN nebula. For more information on the initiative: https://u4ssc.itu.int/, accessed 16 July 2022.
5 For more information on the URBAN2030 and URBAN2030-II projects: https://urban.jrc.ec.europa.eu/sdgs/en, accessed 31 July 2022.
6 The Handbook can be accessed online: https://publications.jrc.ec.europa.eu/repository/handle/JRC118682, accessed 07 July 2022. A series of technical reports and articles on SDG localisation linked to the development of the Handbook (Ciambra 2021; Gea Aranoa 2021; Hidalgo Simón 2021) can be accessed at this link: https://is.gd/0CtTVj, accessed 07 July 2022.

Analytical design and methods

LRGs and their VLRs and sustainability reports are making local information available that was not so readily accessible before. This information is crucial for the implementation of the 2030 Agenda. Observers of SDG implementation as an intergovernmental process have pointed out that 'further investment is needed to establish local SDG monitoring frameworks, identify local indicators and facilitate local data collection' to 'enable evidence-based subnational SDG prioritisation and ensure that no one and no territory is left behind' (Deutsche Gesellschaft für Internationale Zusammenarbeit 2020: 55).

The effort of international institutions to develop standardised approaches to local data is a consequence of this necessity. As studies on urban carbon footprints—a field in which affordable, historical local data has long been available—had already pointed out, localised '[b]ottom-up inventories… are based on different kinds of data' whose diversity can hinder comparability and the applicability of policy interventions, whereas 'a top-down approach' can make data analysis more consistent (Moran et al. 2018: 2). On the other hand, there is a risk in using standardised monitoring as a one-size-fits-all solution to encompass the diverse awareness, technical capacity and political commitment of LRGs. Since the inception of the localisation movement, data 'gaps and quality, compliance with methodological standards, and non-availability of disaggregated data are among the major challenges identified' (Arfvidsson et al. 2017: 103) by local governments that have approached the SDG monitoring mechanisms. Locally designed indicators are often necessary for some LRGs to even begin considering the SDGs as a policy framework.

For this reason, this article assesses the balance between standardised indicator sets developed in the SDG framework and the work that LRGs have put into practice when localising the SDGs and measuring their performance. The output of this comparison can provide valuable information on the current extent of the divide between what policy results and initiatives LRGs consider the most relevant to localise the SDGs and innovate local sustainability policy accordingly and what policy dimensions have globally become a standard measurement unit for SDG compliance and effective implementation of the 2030 Agenda.

Methodology

This analysis takes into consideration the 72 indicators that are included in the 2022 edition of the European Commission's Handbook and runs a simple not-automated semantic comparison with a sample of VLRs and the indicators used in these ($N = 2354$). Since the Handbook was developed at the European level and with the engagement of several European local authorities, the VLR sample is limited to reviews by European LRGs. The sample is constructed by taking into consideration all VLRs from European LRGs available at the time of editing (55) and then thinning down the selection to those documents that meet the following criteria:

- they feature any relevant treatment of data and/or indicators;
- they feature any kind of systematised statistical annex and/or indicator metadata; and
- they (semi-)quantitatively monitor implementation of all SDGs or at least a majority of them.

So defined, the final sample includes 29 VLRs: the municipalities of Alhaurín de la Torre, Barcelona, Madrid, Málaga

(Spain), Asker (Norway), Besançon (France), Bonn, Düsseldorf, Mannheim, Stuttgart (Germany), Bristol, London (United Kingdom), Cascais (Portugal), Espoo, Helsinki, Turku, Vantaa (Finland), Florence (Italy), Gladsaxe (Denmark), Gothenburg, Helsingborg, Malmö, Uppsala (Sweden) and Skiathos (Greece); the province of Jaén (Spain); and the regions of the Basque Country, Castilla la Mancha (Spain), Normandie (France) and Nord-Rhein Westphalen (Germany). Supplementary Table SA1 includes the full matrix of the analysis data.

The matrix provides information on different levels. It shows how many VLR indicators are semantically proximate to each of the Handbook indicators. This information is, in turn, aggregated by SDG, so that it is possible to define proximity for a specific Goal. Finally, proximity between Handbook and VLR indicators can be analysed by VLR, thus measuring the degree of proximity and closeness between one specific local government's choice of indicators and those selected by the European Commission in the Handbook.

The degree of proximity between indicators is defined according to their semantic closeness, i.e. how closely the language and meaning of the indicators can be compared or juxtaposed. Consider the Handbook's indicator on 'Lone-parent private households (with children aged 0 to under 18)' as an example of such comparisons (Siragusa et al. 2022: 55). Accordingly, this analysis identifies the following levels of proximity:

- *High proximity*: meaningful coincidence or overlap of the Handbook metric with that of a VLR—e.g. Alhaurín de la Torre's indicator on 'Households of lone parents (with children)', conceptually overlapping with and almost identical in language to the Handbook's indicator. This level is marked down with the letter H in Supplementary Table SA1.
- *Medium proximity*: comparable metrics that share context, objective or method but whose differences have to be considered—e.g. the Province of Jaén's indicator on 'One-person households', which does not characterise the lone member of the household as a parent. This level is marked down with the letter M in Supplementary Table SA1.
- *Low proximity*: non-comparable metrics that, however, refer to the same conceptual plane and show an analytical interest of the VLR in the same topic or domain as the Handbook indicators—e.g. Malmö's indicator on 'Residents aged 0–19 in economically vulnerable households', linked to economic status and with no reference to the number of parents in the household, thus only vaguely proximate to the Handbook indicator of reference. This level is marked down with the letter L in Supplementary Table SA1.

The 'Indicator proximity and European VLRs' and 'Indicator proximity and the SDGs' sections build on this analysis and present findings and conclusions about European VLRs' proximity with the Handbook's selected indicators and the level of proximity elicited by specific SDGs and their indicators.

Indicator proximity and European VLRs

This section explores to what extent the LRGs that have already published a VLR have converged towards the indicator set that the Handbook selects as a starters' toolkit of accessible, localised and illustrative metrics. To limit the degree of subjectivity in the language analysis of the VLR indicators, when assigning values to indicator proximity, researchers have sought verbatim correspondence, clear and unambiguous synonyms and/or words whose meaning was ostensibly comparable or replaceable with the terms used in the Handbook's indicator set.

To quantify one VLR's closeness to the Handbook, the analysis of indicator proximity provides two main outputs. A 'Proximity Score' (PS) is calculated by weighing each instance of high proximity (H) with three points to stress the relevance of the strong coincidence between indicators; each medium proximity instance (M) with one point; and each low proximity instance (L) with 0.5 points.

$$PS = (n_H \times 3) + (n_M) + (n_L \times 0.5)$$

The analysis also retrieves an 'Indicator Proximity Index' (IPI), which relativises each VLR's PS by dividing the PS by the total number of indicators used in the VLR. This precaution allows the analysis not to overvalue those VLRs with a higher number of indicators. Table 1 collects all information about the 29 VLRs included in this study.

The data show that, overall, there is a meaningful degree of proximity between the indicators used in the sampled VLRs and those selected in the Handbook's set. In absolute terms, 39% (918 out of 2354 total indicators analysed) of all VLR indicators have at least some degree of proximity (high, medium or low) with the Handbook metrics.[7] More specifically, 21.1% of all VLR indicators are highly proximate; 12.9% have medium proximity to Handbook indicators; and only 5.1% of all indicators in the sampled VLRs have a low degree of proximity. This figure shows that VLR indicators and the standardised set of the Handbook are either very close or very far apart, with little grey area in between. When they operationalise data on a common policy dimension, they tend to do so with semantically similar metrics.

As regards the specific measurements developed in the comparison, PS is an absolute measurement of indicator proximity, as it weighs and sums all instances of proximity between Handbook and VLR indicators: the higher the PS, the higher the degree of coincidence. As such, PS tends to reward local governments that include a high number of indicators in their review. The six highest-ranked VLRs by PS all include 100 or more indicators in their analysis: Bristol (147), Málaga (120), Madrid (160), the province of Jaén (110), Barcelona (227) and Mannheim (107). Only 2 VLRs—Helsinki (50) and the region of Normandie (71)—have 50 or more indicators among the 6 lowest PS.

As an absolute measurement that favours quantity over proportion, PS also provides valuable insight. The score of Bristol's VLR—the review with the highest number of high-proximity indicators (34)—shows its significant convergence on the indicators that the European Commission selected in the Handbook. Similarly, Barcelona's document had indicators almost coincident with 27 Handbook indicators out of 72 (37.5%). Considering all levels of proximity, Madrid's localisation strategy had 61 indicators that were, to a varying extent, close to those selected in the Handbook. In other words, even if the impact of proximate indicators in VLRs with larger statistical analyses is relatively low once the total number of used indicators is taken into consideration, the convergence and closeness of certain VLRs to the toolkit defined by the Handbook cannot be neglected. On the other hand, Barcelona's VLR has a third-ranked 29 high-proximity indicators, which account for just

7 In an average VLR from this article's sample, 41.1% of the indicators would have some degree of proximity with the Handbook's standardised set.

Table 1: Proximity data for all European VLRs ($N = 29$) included in the study

VLR	High proximity (H)		Medium proximity (M)		Low proximity (L)		Total # proximate indicators	Total # VLR indicators	% proximate over total	Rank by % over total	Proximity Score	PS rank	Indicator proximity index	IPI rank
	Recount	*% over VLR indicators*	Recount	*% over VLR indicators*	Recount	*% over VLR indicators*								
Alhaurín de la Torre	19	17.4	4	3.7	4	3.7	27	109	24.8	27	63.0	14	0.58	23
Asker	21	23.1	11	12.1	7	7.7	39	91	42.9	13	77.5	10	0.85	15
Barcelona 2020	29	12.8	15	6.6	7	3.1	51	227	22.5	28	105.5	5	0.46	28
Basque Country 2021	14	31.1	7	15.6	5	11.1	26	45	57.8	2	51.5	19	1.14	4
Besançon 2020	5	10.4	6	12.5	4	8.3	15	48	31.3	23	23.0	25	0.48	26
Bonn 2022	17	21.3	17	21.3	10	12.5	44	80	55.0	5	73.0	11	0.91	13
Bristol	34	23.1	12	8.2	4	2.7	50	147	34.0	22	116.0	1	0.79	17
Cascais	12	17.9	9	13.4	5	7.5	26	67	38.8	18	47.5	21	0.71	19
Castilla la Mancha	16	25.0	12	18.8	1	1.6	29	64	45.3	10	60.5	15	0.95	10
Düsseldorf	15	21.1	15	21.1	11	15.5	41	71	57.7	3	65.5	12	0.92	12
Espoo	12	32.4	6	16.2	3	8.1	21	37	56.8	4	43.5	22	1.18	3
Florence	23	22.5	17	16.7	9	8.8	49	102	48.0	7	90.5	8	0.89	14
Gladsaxe	3	10.3	4	13.8	1	3.4	8	29	27.6	25	13.5	29	0.47	27
Gothenburg	14	21.5	11	16.9	1	1.5	26	65	40.0	16	53.5	17	0.82	16
Helsingborg	13	20.6	9	14.3	3	4.8	25	63	39.7	17	49.5	20	0.79	18
Helsinki	9	18.0	5	10.0	4	8.0	18	50	36.0	21	34.0	24	0.68	21
Jaén	29	26.4	20	18.2	2	1.8	51	110	46.4	8	108.0	4	0.98	6
London	14	34.1	9	22.0	3	7.3	26	41	63.4	1	52.5	18	1.28	1
Madrid	27	16.9	23	14.4	11	6.9	61	160	38.1	19	109.5	3	0.68	20
Málaga	32	26.7	13	10.8	6	5.0	51	120	42.5	15	112.0	2	0.93	11
Malmö	12	29.3	4	9.8	3	7.3	19	41	46.3	9	41.5	23	1.01	5
Mannheim	29	27.1	17	15.9	2	1.9	48	107	44.9	11	105.0	6	0.98	7
Normandie	5	7.0	3	4.2	3	4.2	11	71	15.5	29	19.5	26	0.27	29
NR-Westphalia	17	27.9	7	11.5	2	3.3	26	61	42.6	14	59.0	16	0.97	8
Skiathos	2	5.4	12	32.4	0	0.0	14	37	37.8	20	18.0	27	0.49	25
Stuttgart	28	36.4	12	15.6	2	2.6	42	77	54.5	6	97.0	7	1.26	2
Turku	23	17.0	9	6.7	2	1.5	34	135	25.2	26	79.0	9	0.59	22
Uppsala	4	12.5	5	15.6	1	3.1	10	32	31.3	23	17.5	28	0.55	24
Vantaa	18	26.9	9	13.4	3	4.5	30	67	44.8	12	64.5	13	0.96	9
Totals/averages	496	21.1	303	12.9	119	5.1	918	2354	39.0		63.8		0.81	

12.8% of the document's 227 indicators. Considering all degrees of proximity, only 22.8% of the city's indicators are close to those of the Handbook. To consistently assess the degree of convergence between one VLR's data and the indicators that the Handbook is recommending as a standard monitoring core, it is only fair to relativise the measurement of statistical proximity and avoid a quantity bias.

Accordingly, the IPI relativises the PS according to the number of indicators in each VLR. This lowers the impact of reviews that include a larger number of indicators and rewards those reviews that—albeit less reliant on statistical data—manage to have a high proximity to the Handbook indicators. Four VLRs with fewer than 50 indicators are among the six highest-ranked by IPI. Out of a total 41 indicators, London's VLR has 14 indicators (34.1%) with high proximity with Handbook indicators. Even with an overall low number of indicators, London's VLR has a high degree of coincidence with the Handbook. This is particularly relevant when considering that LRGs have often been vocal about how difficult it can be for authorities at the local level not only to manage data but also to identify indicators that can adequately render the information they are able to collect about their territories and communities.

Figures 1 and 2 show the 29 VLRs analysed in this study, ranked by their PS (left) and their IPI (right).

The relative percentage of proximate indicators over the total number of metrics used in a VLR (Fig. 3) is another useful output of the analysis. Six VLRs out of 29 in the sample have >50% of their indicators with some degree of proximity to the Handbook. Almost two-thirds of London's indicators (63.4%) have some degree of proximity with the Handbook. 36.4% of Stuttgart's VLR indicators show high proximity to Handbook indicators—a datum which, combined with the VLR's relatively small statistical toolkit, yields the second-highest IPI (1.26). Overall, four VLRs have over 30% of their indicators with a high level of proximity. While in absolute figures Barcelona's indicators would show a very significant convergence with the Handbook's toolkit, its 51 proximate indicators are fewer than one-fourth of all the metrics included in its methodology. The city's statistical document has the fifth-highest PS and the third-highest number of proximate indicators, but it ranks second-to-last in IPI and in proximate-indicator percentage over total. Since the Handbook only picked 72 indicators, it is unrealistic to expect high coincidence with reviews that handle large amounts of data: in Barcelona's case, however, data show that almost 78% of selected indicators are meaningfully different or distant from the vantage point of the European Commission and the Handbook.

Some of the values at the extremes of the spectrum may affect the averages and require additional explanation. Madrid's localisation strategy ranks third for PS (109.5) partly because it focuses on specific policy dimensions: over 61 proximate indicators, the strategy has 10 indicators on 'Transparency in public administration' and 6 indicators on 'Unemployment rate'. The French region of Normandie has a low PS (19.5) and ranks last in IPI (0.27) mostly because the VLR selects extremely localised indicators (e.g. performance in education and training is measured according to regional certifications and requirements). The Greek municipality of Skiathos has low overall PS (27th in PS and 25th in IPI) because its metrics refer almost exclusively to tourism, the municipality's largest economic driver and employment sector. Eight proximate indicators in the VLR out of 14 are close to the 'Local tourism intensity' metric selected by the Handbook.

The data do not provide clear indications as if the 72 core indicators selected in the Handbook resonate more with specific types of LRGs. On average, the IPI of municipalities is 0.80, with an average 41% of all indicators being proximate to some degree and 21% being highly proximate to Handbook indicators. VLRs from other sub-national governments (the regions of Basque Country, Castilla la Mancha, Normandie and North-Rhein Westphalia and the province of Jaén) have on average a score of 0.86 IPI, 41.5% proximate indicators over the total number of indicators and 23.5% highly proximate indicators over total. There is no clear evidence that the Handbook toolkit may be either more or less suitable or easily accessible specific types of LRGs.

Indicator proximity and the SDGs

Applying the proximity analysis to the indicators that the Joint Research Centre selected for each SDGs can show on what policy dimensions (and their respective SDGs) standardised toolkits are currently more fine-tuned with the information and data commonly or affordably available to local governments.

When analysing indicator proximity across the different SDGs, the data provide three outputs:

1. *SDG Proximity Score* (SPS): calculated with the same method as for VLRs, i.e. a sum of weighed scores for high (three points per instance), medium (one point) and low proximity (0.5 points). SPS is a rough absolute measurement of the degree of convergence between VLR and Handbook indicators for each SDG.
2. Gross SDG Indicator Proximity Index (gSIPI): SPS is divided by the number of indicators that the Handbook considers per each SDG, in order not to overvalue the score of SDGs with a high number of indicators, e.g. SDG 11, or underestimate SDGs with a low number of indicators, e.g. SDG 2.
3. SDG Proximity Index (SIPI): since the gSIPI would increase every time a new VLR is added to the analysis by adding to the SPS without affecting the number of Handbook indicators per SDG, the gSIPI is further divided by an arbitrary coefficient *i*—i.e. a thousandth of the total number of indicators included in the VLR analysis ($i = 2354/1000 = 2.354$) to keep the final value reasonably high for the convenience of the reader and the sake of comparison.

Table 2 shows available proximity data for the 72 Handbook indicators, grouped by the 17 SDGs. Ultimately, SIPI is the most 'universal' measurement as it is independent from the number of VLRs that are being analysed and is always relativised to the total amount of indicators included in the analysis. This is essential to make SIPI analyses with a specific subset or amount of VLRs comparable with each other—e.g. for a time-series analysis over a specific period, or for VLRs published by LRGs in a specific region or of a specific kind. The analysis of all data and scores, however, provides valuable insights on how proximate the Handbook's indicators are to those chosen by European LRGs.

Figure 4 shows the SDGs as ranked by their SPS, but their values are coupled with each SDG's total number of proximate indicators—of whichever degree. SPS is a cumulative score that shows which SDG provides the highest absolute degree of proximity between Handbook indicators and the metrics used in the VLRs. Since SPS weighs the 'quality' of indicator proximity in,

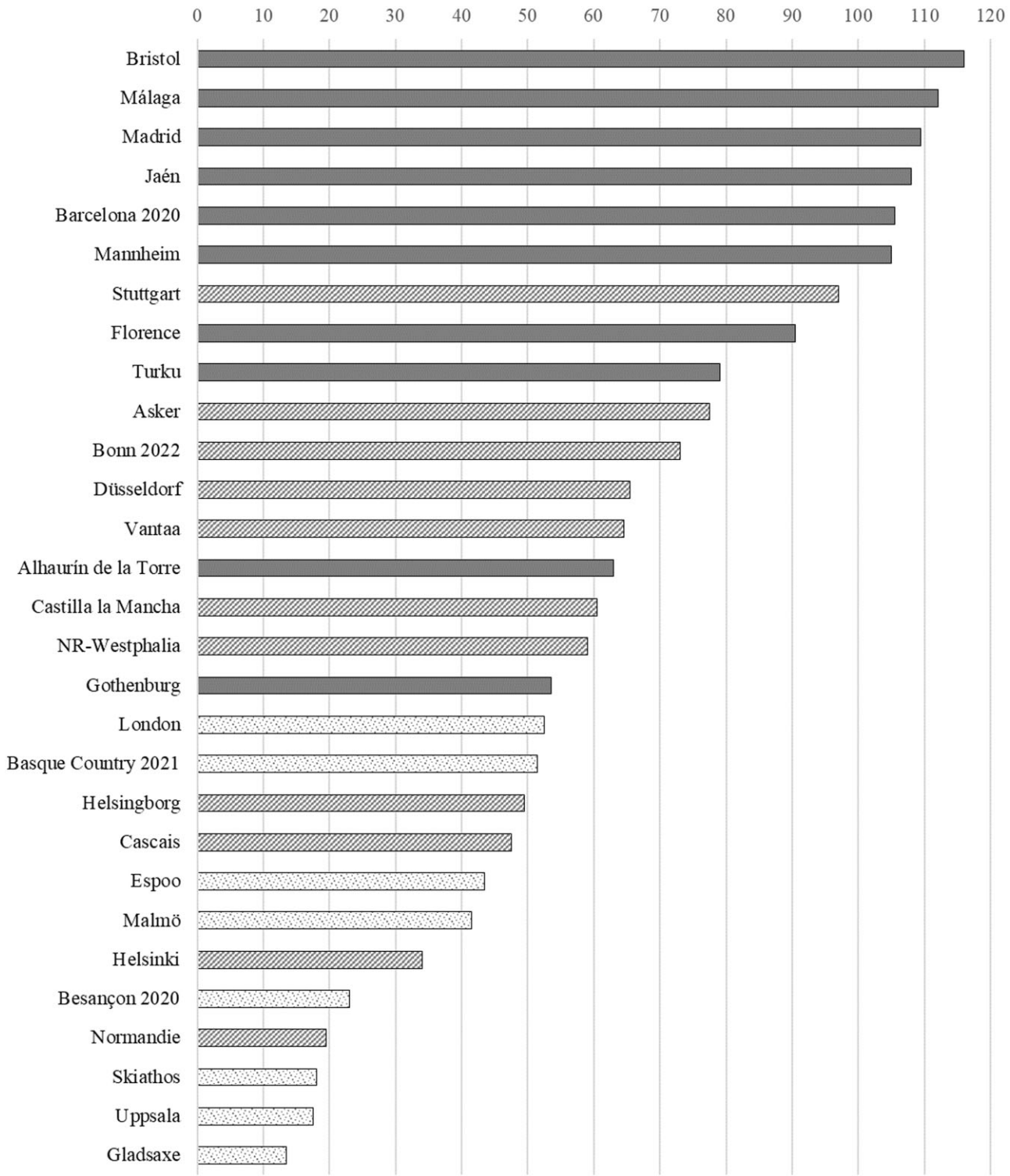

Figure 1: VLRs ranked by PS

its measurement is more 'accurate' than the simple sum of indicators, as it rewards the SDGs whose indicators tend to be more proximate than others to VLR indicators.

SDG 11 is the SDG which features the most total proximate indicators (102). This is not unexpected, considering that:

1. SDG 11 has been designed as the 'urban SDG' (Klopp and Petretta 2017; Rozhenkova et al. 2019) since the inception of the 2030 Agenda—when a global coalition advocated for at least one of the Goals to have a specifically urban design, following up on the idea that 'special attention to the structure

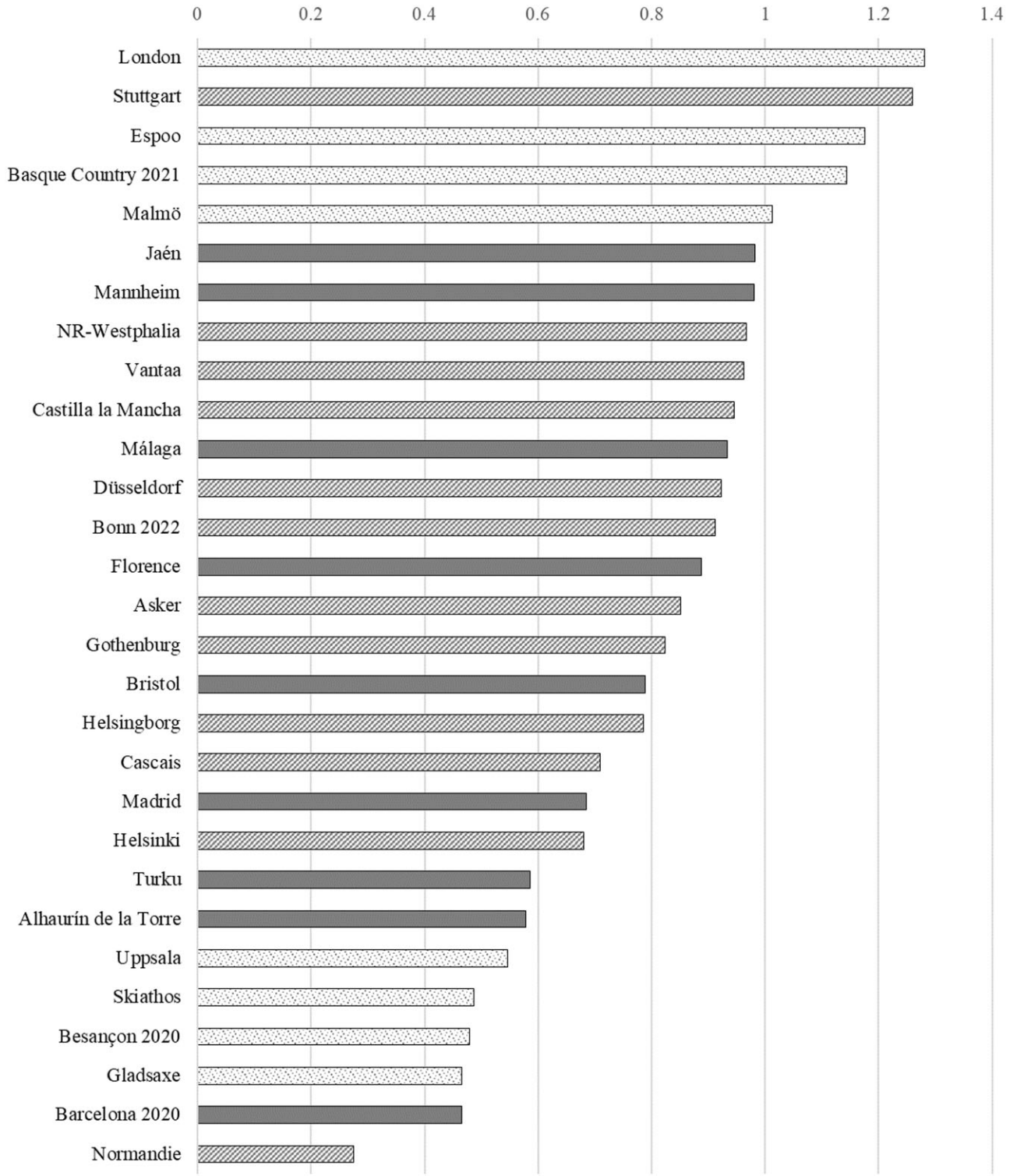

Figure 2: VLRs ranked by IPI

and dynamics of urban areas is essential and potentially transformational, given their social, environmental and economic impact' (Simon et al. 2016: 50);

2. SDG 11 includes policy dimensions such as accessible housing, sustainable transport, design of and access to public and green space and sustainable and inclusive urban design—all dimensions about which LRGs are usually able to collect and manage reliable and affordable data; and
3. Because of its centrality to localisation, the Handbook includes nine indicators under SDG 11, the most for all SDGs. Ultimately, it is simply more likely for SDG 11 to have more occurrences of proximity than other SDGs in absolute numbers.

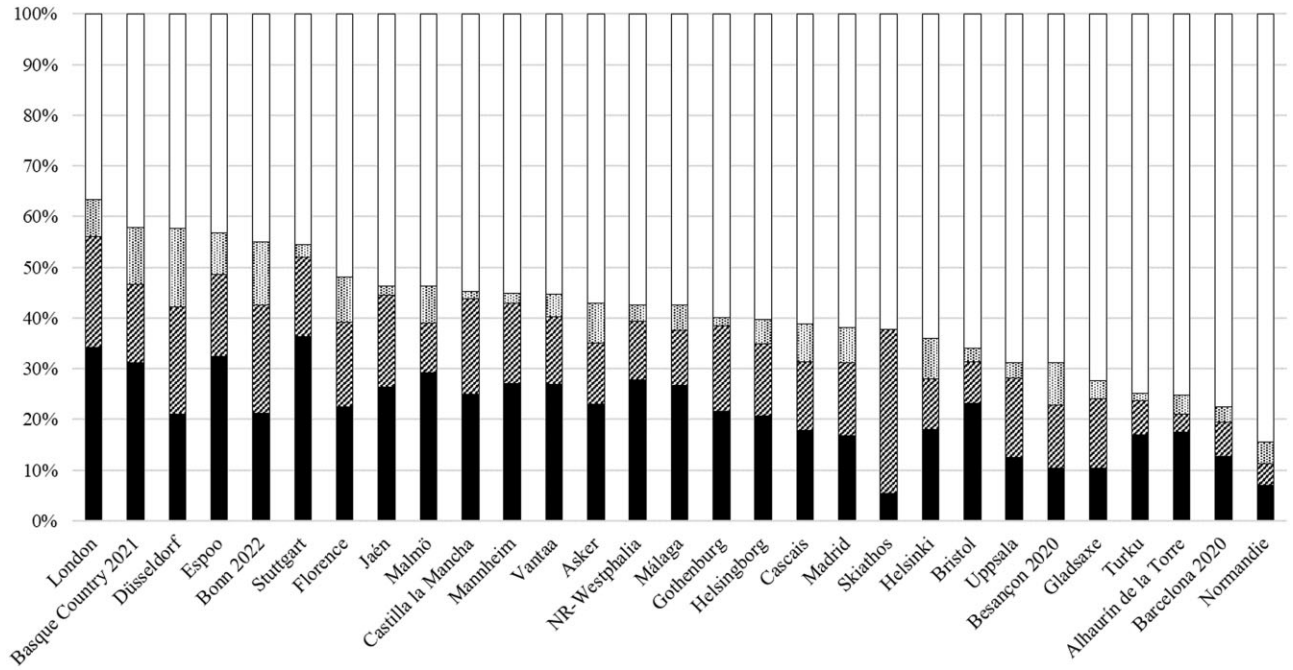

Figure 3: European VLRs sorted by relative weight of high- (full bars), medium- (striped bars) and low-proximity (dotted bars) indicators over the total amount of indicators used (in %)

On the other hand, SDG 8 is the Goal with the highest SPS. SDG 5 too has a higher SPS than the 'urban' SDG. This can be explained considering that both SDG 8 and SDG 5 have more high-proximity indicators than SDG 11, raising their scores once the 'quality' of proximity is taken into consideration. It is also important to consider a bias in indicator selection by LRGs when it comes to key policy dimensions that are also easy, accessible and affordable to measure. SDG 5 has a total of 86 proximate indicators. Thirty-four of these (39.5%) are high- and medium-proximity indicators conceptually close to the 'Gender employment gap' metric selected in the Handbook. SDG 8 has a total of 97 proximate indicators, 55 of which (56.7%, including 35 high-proximity matches) are indicators close to the Handbook's 'Unemployment rate' indicator. This metric is by far the most common indicator across all VLRs (only four documents do not include any indicators close to it): its SPS (125) is higher than that of CO_2 emissions-related indicators (107.5) and nearly twice as high than indicators on municipal waste (69) and recycling rates (67).[8]

While these absolute measurements are helpful to see the indicators of what SDGs are cumulatively more proximate between European VLRs and the Handbook, SPS is still biased on quantity: the five SDGs with the highest SPS average 5.8 indicators per SDG in the Handbook list, whereas the five lowest ranked average just 2.8 indicators per SDG. The SDG Indicator Proximity Index (SIPI) attempts to reduce this bias by relativising the SPS to the number of indicators that the Handbook includes for each SDG and the total number of indicators analysed in the study. Figure 5 ranks the SDGs according to their SIPI.

The SIPI provides a different overview of what SDGs elicit the highest proximity between VLRs and the Handbook. SDG 11, the urban SDG, drops to fifth-to-last, with a SIPI (8.24) of lower than half that of SDG 12 (16.67) and SDG 8 (16.64).[9] Because of the accessible and affordable data that they require—e.g. unemployment rate, collected municipal waste, recycling rates, GDP per capita or accidents at work—these SDGs appear to be more likely to be included in local monitoring. SDG 4 has the third-highest SIPI (16.07) but just three indicators in the Handbook: all of them measure performance on policy dimensions that are often a competence of local authorities (school enrolment and dropping out and the provision of public and accessible childcare) through data that is often very easily accessible to local governments.

On the lower SIPI spectrum, SDG 11 is affected by being the SDG with the most indicators (nine) in the Handbook. Even if some of these indicators elicit relatively high proximity—access to public transportation, land use (built-up surface) and PM_x concentration in particular—the SDG's high absolute figures of proximate indicators are diluted across several metrics that do not coincide with those of many VLRs. Accessibility of public and green space and the Handbook's approach to housing policy do not resonate with the dimensions of the urban SDG that the VLRs are emphasising.[10] Lastly, the Handbook also highlights that all 'SDGs have a local dimension in which cities are called to take action' and that, accordingly, 'many of the indicators normally used to measure the SDG 11 are listed in other goals' (Siragusa et al. 2022: 150).

The SIPI of SDG 10 (5.26, the lowest in the analysis) may warrant additional analysis. SDG 10, as a Goal addressing all instances of inequality, covers a broad spectrum. Under SDG 10, some VLRs have included metrics on socio-economic equality and discrimination against gender, faith, age, sexual

8 The SDG PS of all Handbook indicators is available in Supplementary Table SA3.

9 Full proximity measurements for SDGs are available in Supplementary Table SA1.

10 'Housing access index' (SPS=11) ranks 53rd out of 72 indicators. 'Population without green urban areas in their neighbourhood' (8.5) ranks 57th.

Table 2: Proximity data for all indicators, as selected in the Handbook, grouped by SDG (Siragusa et al. 2022)

SDG	High proximity	Medium proximity	Low proximity	Total proximate	Indicators per SDG	SPS	SPS rank	gSIPI	SIPI	SIPI rank
SDG 1	24	26	5	55	5	100.50	10	20.10	8.54	12
SDG 2	19	21	1	41	3	78.50	12	26.17	11.12	8
SDG 3	35	13	3	51	5	119.50	7	23.90	10.15	9
SDG 4	32	16	3	51	3	113.50	8	37.83	16.07	3
SDG 5	50	34	2	86	5	185.00	2	37.00	15.72	4
SDG 6	37	15	3	55	4	127.50	6	31.88	13.54	5
SDG 7	19	7	11	37	3	69.50	13	23.17	9.84	10
SDG 8	69	28	0	97	6	235.00	1	39.17	16.64	2
SDG 9	18	23	5	46	5	79.50	11	15.90	6.75	14
SDG 10	13	7	7	27	4	49.50	15	12.38	5.26	17
SDG 11	42	37	23	102	9	174.50	3	19.39	8.24	13
SDG 12	48	12	2	62	4	157.00	4	39.25	16.67	1
SDG 13	41	14	7	62	5	140.50	5	28.10	11.94	6
SDG 14	5	6	8	19	2	25.00	16	12.50	5.31	15
SDG 15	15	9	17	41	3	62.50	14	20.83	8.85	11
SDG 16	23	32	14	69	4	108.00	9	27.00	11.47	7
SDG 17	6	3	8	17	2	25.00	16	12.50	5.31	15

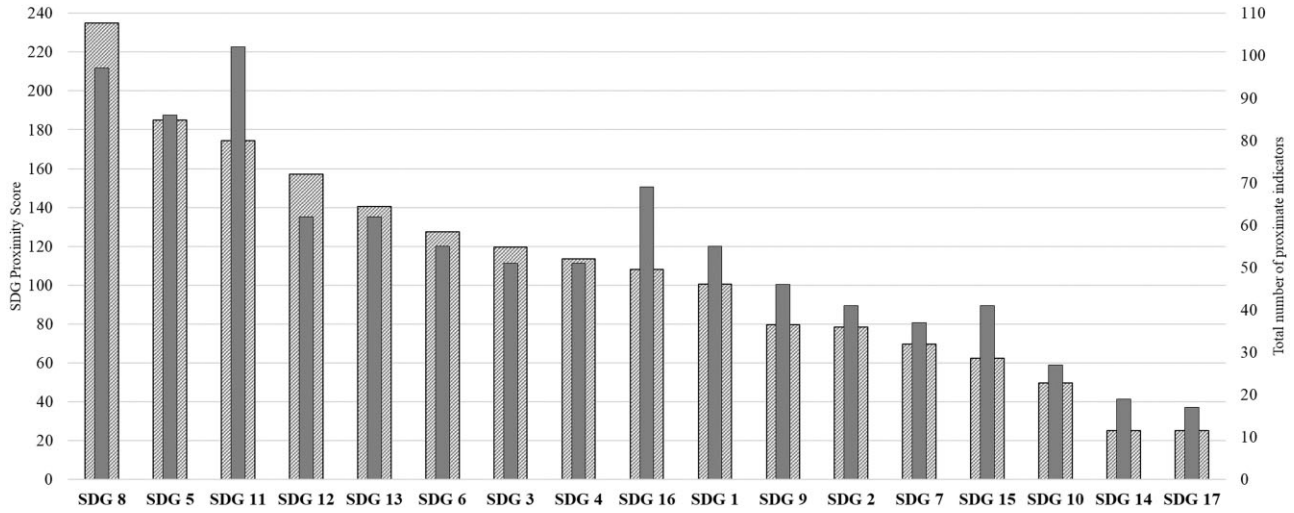

Figure 4: SDGs ranked by SPS (striped bars) and total number of proximate indicators (full bars)

orientation and migrant population under the SDG 10 umbrella. However, the UN targets and indicators for SDG 10 favour a narrower interpretation that mostly addresses income equality within societies as well as among countries and regions. This potential mismatch in policy focus may at least partly explain the low proximity between the Handbook's expansive approach to SDG 10 and the indicators that are more commonly used for it.

Finally, SDG-based analysis of proximity data could help fine-tune the approach of standardised indicator sets to certain policy dimensions as embodied by the SDGs. Supplementary Table SA2 provides an overview of proximity data for each of the Handbook's 72 indicators.

Conclusions

The analysis performed in this article shows that there exists a significant degree of proximity between the indicators that are selected in standardised data toolkits for SDG monitoring, such as the European Commission's Handbook, and the metrics that LRGs are using in policy and implementation review. Data on a sample ($N = 29$) of European VLRs that include indicators and provide consistent data on all or most SDGs show that over 41% of all indicators analysed ($N = 2354$) have at least some degree of proximity with the 72 indicators included in the 2022 edition of the Handbook and over 20% of all indicators are highly proximate to Handbook metrics.

Analysis of local reviews shows that documents with larger indicator sets inevitably tend to have higher absolute proximity (PS) than smaller reviews: the 6 reviews with the highest PS all have >100 indicators in their toolkits. However, when considering the size of the statistical toolkits of each review (IPI), 4 of the 5 VLRs with the highest IPI have 45 indicators or fewer. Seven VLRs out of 29 in the sample have 50% or more of their indicators proximate to Handbook's metrics and also show that proximity is not clearly related to clear explanatory variables: larger municipalities have similar proximity indexes to smaller LRGs, and there is no meaningful variation between the scores of regional/provincial governments and those of municipalities.

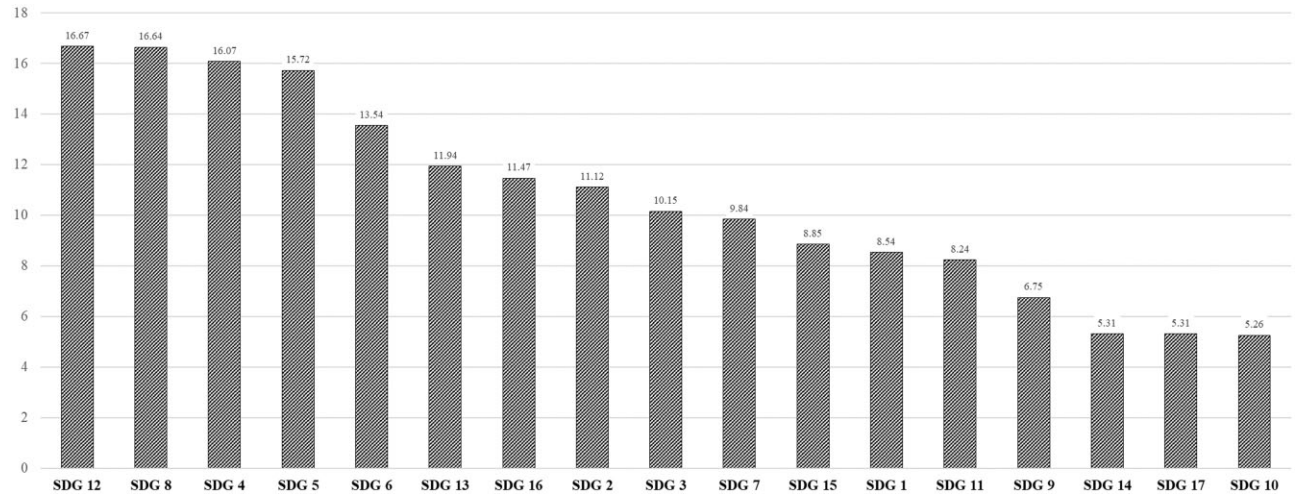

Figure 5: SDGs ranked by their SDG IPI

Analysis by SDGs shows that certain Goals seem to elicit higher levels of proximity between real-life indicators and data usage in VLRs and the standardised sets developed for guidance. SDG 12 on sustainable consumption and production and SDG 8 on decent work and economic growth have the highest PS, when relativised by the number of indicators per Goal included in the Handbook and the total number of indicators explored in the analysis. Generally, SDGs with high proximity tend to include indicators measured with common and easily available data that LRGs can collect affordably: data on greenhouse gas emissions, recycling rates, gender equality in employment and political representation, access to and use of public transport and unemployment rate are among the most common indicators that are both present in the standardised set and commonly adopted by most VLRs. Proximity by SDG can offer guidance to global frameworks to adjust or recalibrate what they consider as a 'standard' of SDG implementation to the specificities of local realities.

Finally, potential new research on this topic should consider replicating this kind of proximity analysis at different point in times and with a larger N of (European and non-European) VLRs with adequate data and indicator-based resources and information. The IPI and the SDG proximity methodology are already designed to be compatible with this kind of time-based comparison. This could help analysts to assess how the gap between standards defined at the global level and the real-life practice of LRGs implementing the SDGs locally evolves.

Supplementary data

Supplementary data are available at *JUECOL* online.

Institutional review board statement

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Conflict of interest statement. None declared.

Data availability

Data underlying our research are freely available to others, wherever legally and ethically possible, and can be found in the Supplementary material of the article and can be also made available upon request.

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