

Sister City Index Algorithms and Publication Methodology

Sister City Opportunity Index and Sister City Partnership Performance Index

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The two indexes answer different decisions. The Sister City Opportunity Index identifies international city relationships worth investigating. The Sister City Partnership Performance Index measures the documented work and results of established partnerships. Their scores should be published separately.

This document describes the existing Opportunity calculation and proposes a reproducible Performance model. It also defines the subordinate algorithms, evidence rules, and publication fields that allow a reader to understand and reproduce a release.

Product	Algorithm status	Meaning of the score
Sister City Opportunity Index	Existing calculation documented from source code	Priority for investigating a U.S. metro and foreign city relationship
Sister City Partnership Performance Index	Proposed pilot design in this document	Documented delivery and results of an established bilateral partnership

What is ready to publish

The methodology can be published as a draft. A live Opportunity ranking still requires the selected database export, its actual source versions, run identifier, coverage, and validation results. The latest populated results and final execution certification were not recovered in this review. Performance scores have not been calculated or validated.

The Performance weights, targets, and thresholds below are explicit starting assumptions for a pilot. They are not presented as scientifically calibrated benchmarks or as a model already implemented by NDS.

How to use this document

Sections 1 through 5 describe the existing Opportunity model and its supporting calculations. Sections 6 through 10 specify the proposed Performance model. Sections 11 through 13 provide publication rules, reader explanations, and source references.

1 Sister City Opportunity Index

The unit of analysis is a U.S. metropolitan area, a foreign country, and a candidate city in that country. The score is directional: U.S. metro to foreign city. A reverse-direction score is not calculated automatically. [N4 N5]

$$\text{SCOI} = \text{round}_2 \{ \text{clamp}_{0-100} [0.35G + 0.25B + 0.20P + 0.15C + 0.05S] \}$$

Input	Published component name	Weight
G	Global Consumer Opportunity Index	35%
B	International Community Bridge Index	25%
P	City Population Index	20%
C	Country Conversion Percentile	15%
S	U.S. Metro Affinity Score formerly Upstream Match Strength	5%

The three index names are proposed publication names for existing score components. C and S are supporting measures. All inputs enter on a 0–100 scale. In the legacy calculation, missing inputs become zero and weights are not redistributed. Rounding and clipping follow the source SQL. [N5]

Candidate eligibility

The city builder reads the identity-supported sister-city-ready country-metro lead table. The upstream route requires G of at least 60, a nonmissing B, C of at least 50, and a qualifying Sister City Research or Diaspora Outreach lane. Sister City Research requires $C \geq 85$ and $B \geq 80$; otherwise $B \geq 70$ can qualify for the Diaspora lane. These are route rules, not proof of an established partnership. [N4]

Country identifiers are resolved to ISO3 and U.S. foreign-city candidates are excluded. GeoNames identifiers or country plus city plus administrative area and valid coordinates identify foreign places. Duplicates are removed before city selection. The builder accepts populated-place records and records whose feature class is missing. [N5]

How city candidates are selected

Default parameters retain at most 250 eligible cities per country and 25 cities per country-metro lead. Known city populations must be at least 50,000; records with missing population can remain as explicitly unranked population candidates. These limits make a screened research universe rather than a census of all cities. [N5]

Source [N4] Global Candidate V1.0.2 and [N5] International City Candidate V1.0.3.

2 Global Consumer Opportunity and Conversion

G combines country-to-metro conversion signals with available community evidence and U.S. metro affinity. Its input is the existing enhanced conversion dataset. The algorithm ranks signals in that dataset; it does not establish that the signals are measured city-to-city visits, demand, or future sales. [N4]

Country Conversion Percentile

The code bounds global conversion potential to 0–100. Values whose absolute magnitude is at most 1 are multiplied by 100 first; a missing value becomes zero. Consumer activity and conversion efficiency are also bounded to 0–100 with missing values replaced by zero. [N4]

$$C = \text{round}_2 [100 \times \text{CUME_DIST within country (V, A, E)}]$$

$$O = \text{round}_2 [100 \times \text{CUME_DIST across all source rows (V, A, E)}]$$

V is normalized conversion potential; A is normalized consumer activity; E is normalized conversion efficiency. The ordering is ascending and lexicographic: V first, A next, E last. CUME_DIST returns the proportion of rows at or below that ordered tuple, including ties. C compares source metros for one country; O compares all source country-metro records. [N4]

Global Consumer Opportunity Index

When B exists, the existing formula is:

$$G = \text{round}_2 \{ \text{clamp}_{0-100} [0.45C + 0.20O + 0.25B + 0.10S] \}$$

When B is missing, the upstream G formula becomes:

$$G = \text{round}_2 \{ \text{clamp}_{0-100} [0.65C + 0.25O + 0.10S] \}$$

Conversion-only rows can support a global consumer product. The reviewed international-city pipeline selects identity-supported leads, so its normal scoring path uses the first formula. [N4 N5]

Combined weights after nesting

Underlying input	Approximate effective weight in SCOI
Community bridge B	33.75%
Country percentile C	30.75%
City population P	20.00%
U.S. affinity S	8.50%
Overall percentile O	7.00%

These weights follow algebraically from substituting G into SCOI when B exists, before intermediate rounding and clipping. They describe overlapping inputs; the five headline components are not independent. They also do not eliminate overlap within B or S. A redesigned weighting system would require a new analytical version.

3 International Community Bridge Index

B measures a country-origin community foundation in a U.S. metro. The reviewed country bridge specifically selects the BIRTHPLACE lens from eligible CBSA identity records. Ancestry remains a separate upstream lens. The current country-to-metro B should therefore be described as birthplace-based, rather than as an ancestry-plus-birthplace population total. [N2 N3 N4]

Build the community evidence

Within one identity and lens, aggregate eligible contributing ZIP records assigned to the market. Let X be the sum of identity population and U the sum of their universe population. Let $s = X/U$ when U is positive. Relative representation is $100 \times s/n$, where n is the national share computed from the source ZIP universe. Keep the identity and lens separate throughout. [N2]

The contributing ZIPs have already passed candidate filters. As a result, X and U describe the source-covered contributing footprint. They must not be advertised as exhaustive CBSA population totals or a complete metro share without a separate denominator reconciliation. ZIP and Census ZCTA identities also require their governed geographic bridge. [N1 N2]

Calculate the metro score

$$B = \text{round}_2 [0.35F + 0.25K + 0.25R + 0.15Z]$$

F is the market population percentile, K the concentration percentile, and R the representation percentile within the same identity, lens, and geography level. Z is the highest contributing ZIP priority score. This formula applies when at least one ZIP has the full direct-evidence basis. [N2]

The source has separate context branches: ethnicity context uses $15 + 0.35F$; a market without direct ZIP evidence uses $0.50F + 0.20Z$. These context branches do not enter the reviewed country bridge, which retains birthplace records in Anchor, Ready, or Signal tiers. [N2 N3]

Calculate the subordinate ZIP priority

$$Z_i = \text{round}_2 [0.40f_i + 0.30k_i + 0.30r_i]$$

The lowercase terms are population, concentration, and representation percentiles for ZIP i within its identity and lens. When both share and representation are missing, the scale-only branch is $35 + 0.45f_i$. Ethnicity context uses $15 + 0.35f_i$. Missing percentile terms become zero. Market visibility is a different screening score: $0.45f_i + 0.30k_i + 0.25r_i$. [N1]

Publish the percentile implementation

The existing ZIP and market percentile SQL includes geography identifiers as secondary ordering fields. Equal measured values can therefore receive different percentiles. Publish this behavior with the legacy release; a change to tied-value treatment requires a new version and recalculation. Community evidence identifies research leads and does not establish the preferences or behavior of individuals. [N1 N2]

4 U S Metro Affinity and Upstream Match Strength

S is the maximum inherited match score among the retained published U.S. metro pairs involving the U.S. metro. It does not vary by the proposed foreign city and is not necessarily specific to the selected foreign country. “U.S. Metro Affinity Score” is the clearer public label. Preserve the internal field `max_sister_city_match_score` in the technical dictionary. [N4]

Shared identity pair algorithm

For one shared identity and lens, compare two eligible markets A and B at the same geography level. Eligible pair inputs use ancestry or birthplace evidence, at least one direct-evidence ZIP, population of at least 500, and an Anchor, Ready, or Signal tier. The default screen retains the top 150 markets per identity and lens. [N2]

$$L(x,y) = 100 - \min(100, |x - y|)$$

$$I = \text{round}_2 \{ \min[100, 0.40B_{\text{avg}} + 0.25D_{\text{pop}} + 0.25D_{\text{rep}} + 0.10D_{\text{bridge}}] \}$$

I is the identity pair score. B_{avg} is the mean of the two community bridge scores. D_{pop} , D_{rep} , and D_{bridge} apply L to the pair’s population percentiles, representation percentiles, and bridge scores respectively. Missing comparison inputs become zero in the legacy code. [N2]

Aggregate shared identity signals

$$M = \text{round}_2 \{ \min[100, 0.60 \text{mean}(I) + 0.25 \text{max}(I) + 0.15 \min(100, 12n)] \}$$

n counts shared identity–lens signals for the market pair. Mean and maximum use all retained signals; the top five signals explain the pair in the public record. The code labels $M \geq 85$ with at least three signals Strong; $M \geq 75$ with at least two signals Ready; $M \geq 65$ Signal; otherwise Context. Conditions are evaluated in that order. [N2]

$$S = \text{max}(M) \text{ over retained published U.S. peer matches}$$

The global builder takes this maximum after reading the publication layer. Publication filtering therefore helps define the S universe; S is not a maximum over every possible U.S. metro pair. Preserve the source publication version and its retained rows. [N3 N4]

Keep the meaning of the evidence clear

Ancestry and birthplace signals can overlap in the people they describe. Counting shared signals is an algorithmic evidence count, not a count of unique people, active cross-border relationships, or independent proof points. The source rule preserves lenses separately and does not authorize adding their populations. [N2]

5 City Population Index and Opportunity Publication

P measures population prominence among the source city/place records in the candidate country. GeoNames city/place population is not metropolitan population. This component describes source-covered population rank rather than economic power, institutional capacity, or bilateral fit. [N5]

$$P = \text{round}_2 \left\{ 100 \times \left[1 - \frac{r - 1}{N - 1} \right] \right\}$$

r is descending population rank within the country using SQL RANK. N is the number of deduplicated, matched source city records in that country with known population, before the minimum-population and city-count selection limits. P is null if population is missing or $N \leq 1$. Population ties share r; selection ties use source rank, city name, and identity. [N5]

Opportunity score labels

Score range	City candidate label	Research priority
90 to 100	Strong	High priority
85 to below 90	Ready	High priority
80 to below 85	Ready	Research target
75 to below 80	Signal	Research target
70 to below 75	Signal	Context target
Below 70	Context	Context target

The candidate label and research-priority label are separate classifications in the code. Within one U.S. metro-country lead, G, B, C, and S are shared by every attached city. P supplies the score differences among those cities. Missing P contributes zero, so the legacy score can fall by as much as 20 points without showing weak observed population. [N5]

Ranking order and reproducibility

The legacy publication order is score descending, then B descending, P descending, country, U.S. metro name, and city name. Within one metro-country group, ties use score, P, city population, and city name.

ROW_NUMBER creates sequential positions even for equal scores. Store the stable city identifier as well; the release must report unresolved ties rather than silently claim that an alphabetical position is a meaningful score difference. [N5]

A hypothetical candidate with G = 90, B = 80, P = 95, C = 85, and S = 70 scores 86.75. Its label is Ready and its research priority is High. These are invented values for arithmetic illustration, not a ranked place.

Before releasing a current ranking, attach the actual run and source snapshots, confirm eligibility, reconcile tied results, and publish missingness. Country-level Foursquare inventory fields in V1.0.3 are context only and contribute no city-priority points. [N5]

6 Sister City Partnership Performance Index

Proposed pilot model. SCPPI assesses the documented delivery and results of an established bilateral city partnership during a completed calendar year. The unit is a unique partnership pair and year. A partnership appears once even when both cities report it. These rules and weights are new design proposals, not a description of an existing NDS calculation.

$$\text{SCPPI} = \text{round}_2 [0.15A + 0.20X + 0.25E + 0.15L + 0.15C + 0.10F]$$

Component	What is assessed	Weight
A Accountability	Joint planning and reporting	15%
X Exchange activity	Delivered activity and reciprocal participation	20%
E Economic outcomes	Business introductions and verified milestones	25%
L Learning and education	Delivered learning and completion	15%
C Community participation	Community reach and practical access	15%
F Follow through and continuity	Sustained work and completed commitments	10%

Sister Cities International's 2015 Measures That Matter study provides historical context on recording exchanges, events, and volunteering. It does not establish the proposed scoring weights or targets. [E2]

This is a commercial diplomacy edition with economic outcomes carrying the largest weight. Partnerships devoted primarily to cultural or humanitarian goals can publish the same component profiles; purpose-specific alternative weights must use a different edition and separate ranking universe.

Eligibility and reporting period

Require an identifiable bilateral agreement or equivalent authoritative record, two named cities in different countries, a partnership identifier, and an evidence contact on each side. Record whether the arrangement is a formal sister-city, friendship-city, or other partnership; rank formal sister-city partnerships together. Use the agreement to establish the relationship's scope.

The primary ranking uses a complete calendar year after the partnership has existed for at least 12 months at that year's start. Younger partnerships receive a New Partnership profile without a full-year comparison rank. For a release prepared during 2026, the most recent completed annual window is January through December 2025. Three-year continuity would examine 2023 through 2025.

Freeze records on June 30 of the following year. This permits 90-day follow-up on late-year introductions and correction review. Confirmed inactivity is an observed zero; unreported activity is missing. A dormant partnership can therefore remain in the eligible population when its zero activity is affirmatively documented.

7 Accountability and Exchange Algorithms

All formulas on this and the next three sections are proposed pilot specifications. Their targets are fixed reference points for reproducibility, not established external standards.

Shared normalization functions

$$T(x,t) = 100 \times \min[1, \max(0, \frac{x}{t})] \text{ for } t > 0$$

$$R(a,b) = 100 \times \frac{a}{b} \text{ for } 0 \leq a \leq b \text{ and } b > 0$$

T is target attainment; R is a completion fraction. A required but missing count or denominator gives a missing metric. An affirmatively verified empty activity cohort gives zero under the specific rules below. Binary evidence indicators are 100 when the stated condition is documented and 0 when its absence is verified.

Accountability algorithm

$$A = 0.40a_1 + 0.30a_2 + 0.30a_3$$

Metric	Evidence condition	Share
a ₁ Joint annual workplan	A dated plan names shared objectives, activities, and responsible organizations for the reporting year.	40%
a ₂ Bilateral ownership	A current named coordinator or accountable organization is documented on both sides.	30%
a ₃ Annual public report	A dated report identifies activities, results, resources, and limitations for the reporting year.	30%

Use the most recent version effective in the year. An unsigned template, press intention, or unilateral claim without corroborating records does not satisfy a joint condition. The evidence ledger distinguishes verified absence from a missing document.

Exchange activity algorithm

$$X = 0.40x_1 + 0.30x_2 + 0.30x_3$$

Metric	Definition and pilot reference	Share
x ₁ Delivered joint activities	T(number of distinct completed qualifying activities, 6)	40%
x ₂ Active quarters	T(number of quarters with at least one qualifying activity, 4)	30%
x ₃ Reciprocal initiative	100 × 2 min(nA,nB)/(nA+nB); verified nA+nB = 0 gives 0	30%

An activity requires identifiable participation from both partner communities and a dated delivery record. One initiative is one activity even when it has several sessions or press releases. nA and nB count activities led or hosted by each side; a jointly led activity contributes 0.5 to each. Virtual activities qualify. Reciprocity measures balance of initiative, not travel spending.

8 Economic Outcomes and Learning Algorithms

Economic outcomes algorithm

$$E = 0.30e_1 + 0.30e_2 + 0.40e_3$$

Metric	Definition and pilot reference	Share
e_1 Qualified introductions	T(distinct accepted business introductions, 12)	30%
e_2 Documented follow up	R(introductions with documented follow up within 90 days, introductions eligible for 90-day review)	30%
e_3 Realized commercial milestones	T(distinct verified project milestones, 3)	40%

A qualified introduction identifies both parties, the commercial purpose, the partnership's facilitating role, and acknowledgment from the parties. An introduction is counted once per unique party pair and purpose during the year. A verified empty introduction cohort gives $e_2 = 0$. Any material unverified part of the cohort makes e_2 missing.

The 90-day cohort consists of introductions made during the reporting year. Follow-up can occur after year-end and is reviewed by the following June 30 cutoff. Each introduction enters the denominator once; the same meeting or email cannot be credited repeatedly.

A milestone requires evidence of an executed paid order or delivered export, an investment actually deployed, or a business operation actually launched. An MOU, proposed deal, delegation meeting, or investment pledge receives no milestone credit. Count one highest realized milestone per project in the year and never count the same milestone again in another year. Report stage and attribution basis.

Financial values, jobs, and investment amounts are contextual reported results with currency, price year, source, and attribution notes. They are not added together as an economic impact figure or weighted into this pilot score. Partnership contribution is a documented association, not a causal estimate of GDP or jobs created.

Learning and education algorithm

$$L = 0.40l_1 + 0.30l_2 + 0.30l_3$$

Metric	Definition and pilot reference	Share
l_1 Completed joint programs	T(distinct completed education or training programs, 4)	40%
l_2 Unique learners	T(unduplicated learners participating during the year, 50)	30%
l_3 Completion	R(eligible learners meeting published completion criteria, eligible learners who began)	30%

Completion criteria and the cohort must be set before delivery. Include only cohorts whose scheduled completion falls within the reporting year. Verified zero eligible learners gives $l_3 = 0$. Count a person once in l_2 across the partnership year; use protected internal identifiers, with only aggregate counts published. Attendance at a ceremonial event alone is not a completed learning program.

9 Community Participation and Continuity Algorithms

Community participation algorithm

$$C = 0.35c_1 + 0.35c_2 + 0.30c_3$$

Metric	Definition and pilot reference	Share
c_1 Community organizations	T(distinct participating nongovernmental organizations, 6)	35%
c_2 Unique community participants	T(unduplicated people in community-facing partnership activities, 100)	35%
c_3 Practical access	100 × documented access features / 3	30%

A participating organization contributes delivery, resources, or an agreed role; a logo or mailing-list entry is insufficient. Community participant counts exclude staff solely performing paid duties. Learners may also appear in the community count when they meet that definition; publish the overlap and do not add the two measures to claim total unique reach.

The three access features are: an openly communicated participation route; a documented fee waiver, subsidy, or free participation option; and a remote participation option or an accessible in-person venue. Each documented feature receives one point. A verified absent feature receives zero; an unknown feature remains missing. This indicator describes documented access arrangements and is not a legal compliance certification.

Do not infer participation, citizenship, preference, or relationship strength from race, ethnicity, religion, or birthplace. These individual characteristics are not performance scoring inputs.

Follow through and continuity algorithm

$$F = 0.40f_1 + 0.40f_2 + 0.20f_3$$

Metric	Definition and pilot reference	Share
f_1 Sustained activity	T(number of active calendar years in the trailing 3-year window, 3)	40%
f_2 Commitments completed	R(due action items completed on time, all action items due in the reporting year)	40%
f_3 Next year continuity	100 × documented continuity conditions / 3	20%

An active year contains at least one verified qualifying joint activity. A year before the partnership existed is a known inactive year for f_1 ; a historical year with unavailable records is missing. New partnerships remain in a distinct age cohort rather than being ranked against mature partnerships as if histories were equal.

Action items must have an owner and original due date registered before the due date. Freeze due items at the cutoff; preserve extensions and canceled items in the audit trail. Verified no due items gives $f_2 = 0$. The next-year conditions are a mutually acknowledged next-year workplan, named delivery owners on both sides, and documented resource commitments. Each receives one point. Current-year workplan credit in A and next-year continuity credit in F refer to different periods.

10 Evidence Coverage and Performance Publication

Evidence ledger

Every metric record needs a partnership ID, reporting period, indicator ID, raw value, numerator and denominator when relevant, unit, source ID, source date, verification status, reviewer, and review date. Activity, participant, organization, and project identifiers support deduplication. Record both cities' geography types and boundaries; a city and a metro cannot silently share the same identity.

Accept authoritative municipal, institutional, program, or transaction records with enough detail to verify the metric. For joint activities and outcomes, seek acknowledgment from both sides or an independent corroborating record. A press release or self-report with no supporting record can remain visible as unverified context but cannot satisfy a scored observation.

Missing values and coverage

Performance uses a different missing-data rule from the legacy Opportunity calculation. Unknown evidence remains missing. Verified absence or a verified empty cohort receives the defined zero. "Not applicable" does not remove a weighted metric in this balanced edition; a purpose-specific edition must define its own complete metric set before data collection.

$$w_j = \text{weight of component} \times \text{weight of metric within that component}$$

$$\text{Coverage} = 100 \times \text{verified observed metric weight sum}$$

All 18 leaf metrics have known weights totaling one. Official ranking eligibility requires 100% weighted coverage, both cities' identity and relationship verification, and the common evidence cutoff. This prevents a partnership from receiving a favorable official rank because low-scoring evidence was omitted.

At 80% to below 100% coverage, publish a Preliminary Unranked profile. A diagnostic score may be calculated as the weighted sum of observed scores divided by the sum of their observed weights, but it must be labeled incomplete and kept outside the official ranking. Below 80%, publish Insufficient Evidence without an overall score. These thresholds are pilot rules.

Ranking and time comparisons

Rank eligible partnerships within the same edition, formal relationship type, reporting year, age cohort, and complete metric specification. Use age cohorts of 1–2, 3–5, and 6 or more completed partnership years as of January 1. Use dense rank on the two-decimal composite; equal scores share a rank and names only order their display. Publish the number ranked and all exclusions. Do not use evidence volume to break a performance-score tie.

Publish the annual score as primary. An optional three-year summary is $0.50 \times \text{latest year} + 0.30 \times \text{prior year} + 0.20 \times \text{earliest year}$, only when all three annual scores meet the same rules. Display it separately. Keep targets fixed across time or recalculate a clearly labeled comparable historical series after a method change.

11 Publication Rules and Validation

Release the score with its evidence

Each Opportunity row should publish the U.S. CBSA identity, foreign country ISO3, stable foreign city ID and administrative area, city population geography and year, G B P C S, source and method versions, score basis, missing-input flags, score, candidate tier, research-priority tier, and rank universe. Add whether a formal relationship is Verified Existing, Verified Absent, or Not Yet Checked. An existing pair can be explored for expansion but must not be advertised as a newly discovered unpaired match.

Each Performance row should publish the partnership and city IDs, relationship type and establishment date, year, six component scores, overall score or evidence status, weighted coverage, rank and peer universe, raw indicator values, verification date, corrections link, and disclosed limitations. Make supporting nonconfidential sources accessible. Publish aggregate participant counts and protect personal records.

Checks before a numerical release

Verify unique keys, geography mappings, bounds, denominators, sample periods, output counts, complete source references, and source-to-score reconciliation. Confirm that equal input data reproduce equal scores, and that proposed Performance weights sum to one at both levels. Test zero activity, missing evidence, single-city source countries, tied populations, duplicate events, late follow-up, and existing formal partnerships.

For both models, vary each top-level weight by plus or minus 20% and renormalize, remove one component at a time, and record rank movements, top-10 membership changes, and score ranges. For Performance, also vary target references by plus or minus 20%. For Opportunity, test neutral tie handling and a population-free scenario as separately labeled sensitivity results. These diagnostics do not silently replace the published method. General normalization, weighting, missing-data, and sensitivity principles are supported by the OECD and JRC handbook. [E1]

Versioning and interpretation

Distinguish a methodology draft, an implemented calculation, a validated run, and a published dataset. Code availability alone does not establish that a run completed successfully. The statistical quality of an index also requires more than passing software checks.

Keep the Opportunity legacy weights, zero substitution, selection caps, and ordering intact when reproducing the existing method. Correcting denominator scope, ties, or missing-data handling changes the analysis and requires a new method version, recalculation, a change log, and comparisons with the prior results. Standalone component indexes need their own declared eligible universe; they should not simply inherit whichever rows happened to survive the parent index.

Weights and pilot targets are design choices. Neither index is a probability of success, an official recognition of a sister-city relationship, or an endorsement by Sister Cities International. Sponsorship, advertising, or application payments must not affect eligibility, evidence review, scores, or ranking positions.

12 Reader Explanations for Publication

Sister City Opportunity Index

The Sister City Opportunity Index helps communities identify international city relationships worth exploring. It combines global consumer opportunity, country-origin community evidence, city population rank, country-to-metro conversion signals, and U.S. metro affinity into a score from 0 to 100. The score indicates research priority. Local institutions, existing agreements, business relationships, and shared objectives must be investigated before outreach or partnership decisions.

Sister City Partnership Performance Index

The Sister City Partnership Performance Index is a proposed annual measure of the documented work of established sister-city partnerships. It examines accountability, exchanges, economic outcomes, education, community participation, and follow-through. Official rankings would require a common reporting period and complete verified evidence. Missing records would be shown as incomplete evidence, rather than treated as proof of inactivity.

Global Consumer Opportunity Index

This component compares country-to-U.S.-metro consumer-opportunity signals in the available source data. It includes conversion percentiles and, where available, community bridge and metro affinity evidence. It is a comparative research measure rather than a forecast of visitors or sales.

International Community Bridge Index

This component maps the community foundations of international relationships. The current country-to-metro calculation uses birthplace-based community evidence in covered U.S. metro areas. It considers population scale, concentration, representation, and supporting ZIP evidence. The score describes the source-covered community foundation; active international organizations and relationships require separate verification.

City Population Index

This component shows how a city's population ranks among the source-covered cities in its country. City boundaries, population dates, and coverage are disclosed. The component measures population rank rather than metropolitan population or overall economic influence.

Supporting measures

Country Conversion Percentile shows the relative position of a U.S. metro within one country's source opportunity records. U.S. Metro Affinity Score supplies context from the metro's strongest retained U.S. peer match. Both support the Opportunity calculation; neither establishes a direct relationship with a particular foreign city.

Status language for the first release

Opportunity methodology documented from existing source code. Current ranking publication awaits verification of the selected results and run evidence. Partnership Performance methodology proposed for pilot development. Component index names are publication labels, and standalone releases require separately documented coverage and validation.

13 Sources and Reproduction Notes

The existing formulas were traced through the following NDS source files. The source chain versions describe the code reviewed, not a certified execution manifest for the current target database. NDS should retain the actual manifest and source versions and provide an accessible release manifest and data dictionary.

N1 Build-NDS-US-Pop-Ancestries-Ethnicities-ZIP-Metrics-V1.0.3.ps1

ZIP percentile, visibility, priority, and evidence-tier algorithms.

N2 Build-NDS-US-Global-Consumer-Sister-City-Metro-Match-US-V1.0.1.ps1

Community rollup, percentile, market bridge, and U.S. affinity algorithms.

N3 Build-NDS-US-Global-Consumer-Sister-City-Metro-Match-Publication-US-V1.0.0.ps1

CBSA publication and birthplace-only country-origin bridge.

N4 Build-NDS-US-Global-Consumer-Sister-City-Global-Candidate-US-V1.0.2.ps1

Conversion percentiles, G formulas, U.S. affinity maximum, and identity-supported lead routes. Reviewed V1.0.1 formulas agree with the V1.0.2 formulas cited here.

N5 Build-NDS-US-Global-Consumer-Sister-City-International-City-Candidate-US-V1.0.3.ps1

ISO3 resolution, foreign-city selection, P and SCOI formulas, labels, order, and context fields.

External methodological context

E1 OECD European Union and European Commission Joint Research Centre. Handbook on Constructing Composite Indicators Methodology and User Guide. 2008. General guidance on normalization, weighting, aggregation, missing values, and sensitivity. It does not validate the NDS weights or the new Performance targets.

<https://publications.jrc.ec.europa.eu/repository/handle/JRC47008>

E2 Sister Cities International. Measures That Matter study announcement of October 7 2015. Historical context on documented partnership activity; no endorsement of this proposed index is implied.

<https://sistercities.org/exchange/global-economic-impact-of-sister-cities-international/>

Appendix Community Evidence Eligibility

These eligibility rules document the existing source behavior. They are distinct from the final international city score tiers and from the new Performance evidence rules. [N1 N2 N3]

ZIP screening and priority tiers

Start with ancestry, birthplace, or ethnicity records with an identity population of at least 500 and a usable identity label. Exclude generic Total, Other, unclassified, and not-reported labels, plus broad birthplace regions such as Africa or Latin America. Retain a record when population rank is at most 500, or market visibility is at least 60 with share or representation evidence, or identity population is at least 1,000. [N1]

Priority branch	Rule applied in order
Ethnicity context	Ethnicity records receive Global Consumer Context.
Population only	When both share and representation are missing, population of at least 10,000 or rank at most 25 gives Scale Lead; otherwise Scale Signal.
Strong	For the remaining records, population of at least 10,000 or population rank at most 25.
Ready	Otherwise population of at least 2,500 or population rank at most 100.
Signal	Otherwise population of at least 500 or population rank at most 500.

A direct-evidence ZIP must use ancestry or birthplace, have the full Population Share and Representation score basis, and receive a Strong, Ready, or Signal tier. A tier label alone does not establish that full evidence exists. The metro algorithm counts these direct ZIPs before selecting its scoring branch. [N2]

Metro evidence tiers

Metro tier	Rule applied in order
Context branches	Ethnicity gives Global Consumer Context. No direct ZIP evidence gives Market Scale Context.
Anchor	At least one Strong ZIP or B at least 90, and covered identity population at least 2,500.
Ready	Otherwise at least one Ready ZIP or B at least 78, and covered identity population at least 1,000.
Signal	Otherwise B at least 60 and covered identity population at least 500.
Context	All remaining records.

In the Anchor and Ready rows, the population requirement applies to the whole preceding alternative in that row. The public country-origin bridge retains CBSA birthplace records in Anchor, Ready, or Signal tiers. Identity IDs and lens IDs remain separate; populations are not summed across lenses. [N2 N3]

Appendix Algorithm Rules and Worked Checks

Opportunity execution sequence

- 1 Freeze source versions and geography identities.
- 2 Calculate ZIP metrics within identity and lens.
- 3 Aggregate covered ZIP evidence to U.S. markets.
- 4 Calculate B and shared identity pair scores.
- 5 Publish eligible CBSA birthplace bridges and U.S. peer matches.
- 6 Compute C and O from the conversion source and compute G.
- 7 Select identity-supported ready country and metro leads.
- 8 Resolve ISO3 and foreign city identity and remove duplicates.
- 9 Calculate source-country population rank P before city caps.
- 10 Select eligible cities and apply the country and lead caps.
- 11 Calculate SCOI with legacy null-to-zero rules.
- 12 Apply candidate labels and publication ordering.
- 13 Attach coverage, source lineage, sensitivity, and existing ties.

Performance execution sequence

- 1 Freeze eligible partnership pairs and the calendar year.
- 2 Build the evidence ledger and deduplicate contributing records.
- 3 Mark each leaf metric observed, verified zero, or missing.
- 4 Normalize the 18 metrics using the published pilot references.
- 5 Compute each component only when its inputs are complete.
- 6 Compute weighted coverage from the 18 leaf weights.
- 7 If coverage is 100%, calculate SCPPI and rank eligible peers.
- 8 If coverage is 80% to below 100%, publish unranked diagnostics.
- 9 If coverage is below 80%, publish insufficient evidence.
- 10 Freeze the release and retain corrections and source versions.

Arithmetic checks

Illustration	Expected result
SCOI inputs 90 80 95 85 70 in G B P C S order	86.75 Ready and High priority
P for source rank 3 with 11 known-population cities	80.00
Performance components A 80 X 70 E 60 L 90 C 75 F 85	74.25 with complete evidence
One missing e_3 metric	10 percentage points of total weight missing and no official rank
All required inputs verified zero	0.00 with complete evidence rather than Insufficient Evidence

These examples check arithmetic and interpretation only. They are invented observations. Sensitivity ranges are scenario results, not confidence intervals or success probabilities. Publishing a new formula or target does not create verified outcomes data.