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Measuring National Entrepreneurial Ecosystems in Africa: A Critical Response

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Measuring National Entrepreneurial Ecosystems in Africa: A Critical Response

Abstract

This paper critically examines the Africa Entrepreneurial Ecosystem Index (AEEI) introduced by Stam et al. (2026) in *World Development*. We identify a series of technical, mathematical, and empirical problems in the construction and interpretation of the index. At the technical level, the paper contains inconsistent notation, equation-level errors, and ambiguities in the definition of key quantities. At the empirical level, the AEEI suffers from important representational limitations, including the exclusion of roughly half of African countries, the combination of indicators drawn from very different time windows, and reliance on data sources whose coverage may reflect platform visibility as much as underlying entrepreneurial activity. The data released by the authors raise questions about the reproducibility of the results, including issues with published rankings, variable construction and country coverage. Moreover, the authors replace missing values by zeros and include these zeros in the calculations, changing the outcomes of the AEEI in a non-predictable way. Finally, we document concerns regarding the paper's text lifting, lack of engagement with prior criticism, and the attribution of related methodological points. Taken together, these issues call into question the usefulness of the AEEI as a scientifically rigorous measure of entrepreneurial ecosystems suitable for comparative analysis and policy use.

JEL classification

L26, C43, O55, B41

Keywords

entrepreneurial ecosystems, Africa, composite indices, replication studies

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1. Introduction

This paper provides a critical response to Stam et al. (2026), published in *World Development*. Stam et al. (2026) introduced an “Africa Entrepreneurial Ecosystem Index” (AEEI). This index combines data from various sources to create a composite index of 21 empirical indicators across seven key dimensions - governance, culture, infrastructure, support, finance, human capital, and market access. The authors claim that their index is “*both scientifically rigorous and societally relevant*” (Stam et al. 2025:1).

Providing a comparable measure of entrepreneurial ecosystems in Africa is potentially important. Composite indicators represent a possible solution when comparable cross-country (micro) data are limited, as is often the case for Africa, and they offer a straightforward way to benchmark countries, diagnose constraints, and identify policy priorities. This is particularly relevant in the African context, where entrepreneurship is central to many policy agendas, including EU initiatives supporting young businesses and entrepreneurial ecosystems in Africa.¹ Because such indicators may inform policymakers, donors, and development actors, their construction requires a high degree of transparency, reproducibility, conceptual clarity, and empirical robustness.

The AEEI proposed by Stam et al.’s (2026) does not meet these standards. The published version of the AEEI raises several serious concerns. We identify inconsistencies in the mathematical exposition, problems in the empirical construction of the index, in replicating the authors’ results, and limitations in the way the resulting measure is interpreted and validated. We also raise concerns about the paper’s engagement with prior critical contributions, showing that it contains direct text lifting, unacknowledged appropriation of ideas, misrepresentation of a critical paper, and moreover a failure to respond to deep criticisms of their approach.

Taken together, these substantial issues cast doubt on whether the AEEI can offer “*scholars and policymakers valuable insights into the structural factors shaping productive entrepreneurship on the African continent*” - as the authors claim. Our contribution, however, goes beyond a critical analysis of the specific AEEI since it adds to the growing literature that is concerned about the concept of so-called “Entrepreneurial Ecosystems” which has become popular in entrepreneurship studies, but which suffers from severe theoretical and empirical shortcomings. See for instance the criticisms in Alvedalen and Boschma (2017); Brown and Mawson (2019); Coad and Srhoj (2023; 2025); Du et al. (2026); and Naudé (2025; 2026).

The remainder of the paper is structured as follows. Section 2 examines technical and mathematical errors in the paper. Section 3 documents replication and empirical problems characterizing the study. Section 4 discusses how Stam et al (2026) failed to engage with the prior literature on the topic, while section 5 adds to these problems of text lifting, misrepresentations and misappropriations in dealing with the prior literature. Section 6 concludes.

¹ See European Commission, International Partnerships, “Investing in Young Businesses in Africa”, https://international-partnerships.ec.europa.eu/policies/global-gateway/investing-young-businesses-africa_en; and European Commission, International Partnerships, “EU-Africa: Global Gateway Investment Package”, https://international-partnerships.ec.europa.eu/policies/global-gateway/initiatives-sub-saharan-africa/eu-africa-global-gateway-investment-package_en.

2. Technical and Mathematical Errors

Stam et al. (2026) contains several mathematical and notational inconsistencies in the exposition of the index construction.

First, as summarized and clarified in Table 1, the authors use multiple and conflicting definitions and notation systems. The subscripts intended to represent countries, dimensions, and indicators are continuously mixed up or dropped entirely. In Equation 1 the formula defines the normalized variable on the left side with three subscripts (i, j , and k), but the calculation on the right side only uses two subscripts (i, k).

Table 1: Multiple definitions for the same algebraic symbol (i, j, k, n), all of which are on page 8 of Stam et al 2026.

Algebraic symbol	First definition	Second definition	Third definition	Fourth definition
I	“Let Y_{ijk} denote the matrix comprising indicators’ values, where I [sic] ($1,2,3, \dots, n$) denotes the number of indicators and their values within a specific dimension, j ($1,2,3, \dots, m$) denotes the number of dimensions, and k ($1,2,3, \dots, p$) denotes the number of countries under consideration.”	Equation (3): $I_k = \sum_{j=1}^m D_{jk}$	“ i indicates the country”	Equation (6): $I = \sum_{k=1}^7 E_{ik}$
j		“ j is the indicator that is included the dimension” [sic]		
k		“ k describes one of the 7 dimensions that comprises the index”		
n		“ n is the Matrix of index score”		

The notation for i (or I) is particularly confusing. i and I are used interchangeably in the first definition. The variable I appears at the left-hand-side of both equations (3) and (6). Also, immediately after equation (4) we read that “ i indicates the country” which is confusing, given that k was used to denote countries immediately before equation (1). Also, not only are i and I used interchangeably, but the confusion deepens because capital I also stands for the number of indicators in Section 3.2.1 of their paper as well as for the overall index (basically the AEEI) in Section 3.2.2, equations (3) and (6).

Further, as shown in Table 1 regarding j : equation (1) has the index j on the left-hand-side, but not on the right-hand-side, which seems like a mistake.

Also, regarding n : Equation (5) sums from $j=1:n$, which seems like a mistake because j should be summed up to m , not n . Immediately before equation (1), we read about $i(1,2,3,\dots,n)$ and $j(1,2,3,\dots,m)$; see also equation (3) which sums from $J=1:m$ (where presumably J should be j).

Additionally, none of the seven equations presented on page 8 of Stam et al (2026) is correct. Table 2 lists the equations as given in Stam et al (2026) and comment on the error(s) each contains.

As shown in Table 2, Stam et al (2026) define the exact same three-step process for calculating the index twice, using different and conflicting mathematical notation. First, in Equations 1 through 3, they use $(Y'_{ijk}, D_{jk}$ and $I_k)$ to represent the raw indicators. Immediately following this, in Equations 4 through 6, they repeat the same steps but arbitrarily switch to using $(x'_i, E_i, and I)$ for the indicators.

In essence, in Stam et al (2026) the whole exposition that includes their equations (4) to (6) is redundant as it attempts to describe the exact same indicators, dimensions and overall index as equations (1) to (3).

Furthermore, their Equation (4) is subject to a division-by-zero problem. This is a consequential error because it affects the formal exposition of the index-construction procedure.

In their Table 2, Stam et al. (2026) list as one of the key personality traits of entrepreneurs “Consciousness.” This is, however, not a personality trait. Perhaps the authors had meant “*Conscientiousness*”?

A final technical and mathematical inconsistency is that in their introduction Stam et al. (2026) state that their index leverages “*principal component analysis and weighted aggregation methods.*” This claim is not supported by the reported methodology: Stam et al. (2026) simply do not use any principal component analysis.

Table 2: A critical re-examination of the 7 equations on page 8 of Stam et al (2026).

Number	Equation	Comments
(1)	$Y'_{ijk} = \frac{Y_{ik} - \text{Min}(Y_{ik})}{\text{Max}(Y_{ik}) - \text{Min}(Y_{ik})}$	Not clear why index j is used on the left-hand-side, but not the right-hand-side
(2)	$D_{jk} = \frac{1}{n} \sum_i^n Y'_{ijk}$	Should be $i=1$ (instead of i) under the summation symbol Σ
(2)	$D_{jk} = \frac{1}{n} \sum_i^n Y'_{ijk}$	Indicator n (which occurs two times in the formula) should be n_j , as the number of indicators is different for every dimension j .
(3)	$I_k = \sum_{j=1}^m D_{jk}$	Should be j (not J)
(4)	$x'_i = \frac{x_i - (x)}{(x) - (x)}$	Division by zero, a very basic mathematical error
(4)	$x'_i = \frac{x_i - (x)}{(x) - (x)}$	Should have used Max and Min signs in this equation, similar to equation (1).
(5)	$E_i = \frac{1}{n} \sum_{j=1}^n x'_{ij}$	This equation is wrong and should be: $E_j = \frac{1}{n_j} \sum_{i=1}^{n_j} x'_{ij}$ Note that besides the indicator n_j which varies for every dimension j , the indicators i and j should also be reversed. The summation should use indicator i (not j) because the summation is across the number of variables belonging to dimension j and therefore the summation should be summed up to n_j .
(6)	$I = \sum_{k=1}^7 E_{ik}$	Like (3) and there is a problem of multiple definitions for I .
(7)	Mathematically, for n dimension with x_i dimension score of the index, the geometric mean index is calculated as follows: $AEEI: \left\{ \begin{array}{l} \text{Summative index} = \sum_{i=1}^n x_i \\ \text{Geometric mean index} = \left(\prod_{i=1}^n x_i \right)^{1/n} \end{array} \right.$	Equation does not follow smoothly from the preceding text

3. Empirical and Replication Problems

In this section, we highlight several empirical problems in the paper. These emerge from both a close reading of the article and an independent replication exercise.

3.1 Replication

The authors have made publicly available on Mendeley the dataset containing the elements used to reproduce the index from the data collected and processed by the authors themselves (<https://data.mendeley.com/datasets/bkgpx2765s/1>). While this is not a full-fledged replication package, it does allow scrutiny of important parts of the empirical analysis and helps reveal several issues. In the interest of transparency and reproducibility, we make our replication materials publicly available (at: https://github.com/pietrosantoleri/AEEI_replication) so that the authors and other researchers can evaluate our difficulties in replicating the Stam et al paper's results directly.

First, while Stam et al. (2026) states that their AEEI is available for 27 countries, the Excel file provided via Mendeley report non-missing AEEI values for 28 countries. Gabon is omitted from the published ranking table in Stam et al.'s Table 4, and it is also absent from their Africa map in their Figure 6. However, Gabon surprisingly reappears in Figure 7 of the paper, which cannot be reconciled with the claim that only 27 countries are included. In fact, Figure 7 displays 28 countries. If Gabon was mistakenly excluded from the ranking table, then the published rankings would need to be shifted and are therefore incorrect (see our Table 3 below).

More generally, a change in the number of countries included in the final sample could also affect normalizations and related calculations. Additionally, it makes it unclear which is the sample used in downstream analyses, as the number of observations is never reported consistently. This makes the empirical analysis more difficult to verify and complicates any attempt to replicate the paper's results.

Table 3: Published and corrected AEEI rankings

Country	Published AEEI	Published rank	AEEI incl. Gabon	Corrected rank
Mauritius	4.662	1	4.662	1
South Africa	4.094	2	4.094	2
Morocco	3.583	3	3.583	3
Tunisia	3.534	4	3.534	4
Egypt	3.344	5	3.344	5
Namibia	3.188	6	3.188	6
Algeria	3.055	7	3.055	7
Ghana	2.813	8	2.813	8
Senegal	2.740	9	2.740	9
Rwanda	2.624	10	2.624	10
Kenya	2.570	11	2.570	11
Gabon	omitted	omitted	2.559	12
Nigeria	2.439	12	2.439	13
Côte d'Ivoire	2.352	13	2.352	14
Togo	2.327	14	2.327	15
Tanzania	2.216	15	2.216	16
Gambia	2.200	16	2.200	17
Cameroon	2.097	17	2.097	18
Lesotho	1.982	18	1.982	19
Mali	1.945	19	1.945	20
Angola	1.886	20	1.886	21
Guinea	1.882	21	1.882	22
Ethiopia	1.877	22	1.877	23
Benin	1.833	23	1.833	24
Niger	1.758	24	1.758	25
Uganda	1.733	25	1.733	26
Zimbabwe	1.667	26	1.667	27
Burkina Faso	1.662	27	1.662	28

Second, Table 4 also contains a second problem in the geometric-index columns. Both AEEI scores and rankings differ across the published results and the data contained in the publicly released material. For five countries, the published geometric values are not the ordinary two-decimal rounding of the workbook values, and the corresponding geometric ranks differ as well.

Table 4: Differences between published results and publicly available data

Country	Workbook geometric value	Rounded workbook value	Paper geometric value	Workbook geometric rank	Paper geometric rank
Egypt	0.408	0.41	0.42	6	5
Namibia	0.420	0.42	0.41	5	6
Tanzania	0.219	0.22	0.19	17	19
Gambia	0.194	0.19	0.23	19	14
Cameroon	0.233	0.23	0.22	14	17

Notes: this table reports the original results displayed in Table 4 in Stam et al (2026) and the data reported in the AEEI sheet of their public dataset.

Third, it is unclear whether some zero values in the dataset are genuine zeros or imputed values replacing missing observations. In some Excel sheets in the Mendeley file, especially *RD* and *SMarCap*, country entries that are missing have been recorded as zeros. This raises the question of whether those observations are being treated as true zeros, or as missing values in the construction of the index. This matters because, based on the Excel sheet it is not clear how the paper reaches 27 (28?) countries with non-missing data for these variables, unless some of these apparent missing values are being coded as zeros. From the sheet named *Index_calculations* it is clear that the authors are converting missing values into zeros, even though the true values are positive (see, e.g., Zimbabwe and Gabon for both *SMarCap*² and *RD*³). This cannot be reconciled with their own statement on page 4 that: "*We were able to source complete data for only 27 African countries. We have data for all African countries only for 9 out of 21 indicators: duration of business registration, access to electricity, innovation hubs, venture capital, stock market capitalization, GDP, population, life expectancy, and R&D*" (Stam et al, 2026:4). Most importantly, discarding countries for which these data are not available would entail a substantial reduction in the sample size, which would decrease even more the representativeness of the index.

A related point concerns the kernel distributions reported in Figure 3 of Stam et al's (2026) paper. It is not clear which sample is used as the number of observations is not reported. From our replication exercise, we found that the kernel distributions use the full sample with a varying number of observations depending on the variable (see Figure A1 in the Appendix). Once the figure is restricted to the paper's final 27-country sample, the distributions are often visibly different (see Figure A2). We contend that this is the more appropriate descriptive sample if Figure 3 is meant to characterize the countries that enter the published index ranking. The differences become larger once clearly blank-derived zeros are removed (see Figure A3). These differences are particularly severe for two variables (i.e. *RD* and *SMarCap*). Data in the original Excel file are heavily affected by blank source cells that were converted into zeros before

² For instance, there is evidence for non-zero stock market capitalization for Zimbabwe: the Zimbabwe Stock Exchange dates back to 1896, see https://en.wikipedia.org/wiki/Zimbabwe_Stock_Exchange, see also e.g. <https://afx.kwayisi.org/zse/> and <https://www.statista.com/outlook/fmo/stocks/zimbabwe#market-capitalization>. For Gabon, see e.g. <https://www.statista.com/outlook/fmo/stocks/gabon>

³ Evidence from the source used for *RD*, confirms that these blank cells are indeed missing values and cannot be transformed into zeros. See <https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS>. Zimbabwe, for example, has at least 5 pharmaceutical companies (see <https://www.mordorintelligence.com/industry-reports/pharmaceutical-industries-in-zimbabwe-industry/companies>), such as Pharmanova which appears to invest in R&D, see e.g. <https://pharmanova.co.zw/laboratory/>

normalization. In the 27-country panel: SMarCap falls from 27 observations to 20 once clearly blank-derived zeros are removed; RD falls from 27 observations to 21 once clearly blank-derived zeros are removed.

The same lack of clarity also affects other evidence reported in the paper. For example, Table 3 in Stam et al. (2026) presents summary statistics for the AEEI and its main component indices but does not report the number of observations. In Table 5 below, we replicate these summary statistics and show that N varies substantially across variables. This implies that the reported descriptives are not based on a common sample and therefore should not be read as directly comparable across dimensions.

Table 5: Observations vary depending on the variable

Variable	N	Mean	Median	SD	Min	Max
AEEI	28	2.52	2.34	0.77	1.66	4.66
Governance	53	0.56	0.56	0.17	0.06	0.93
Culture	31	0.54	0.52	0.12	0.29	0.78
Support	53	0.14	0.08	0.17	0.00	0.87
Finance	52	0.14	0.08	0.16	0.00	0.93
Infrastructure	48	0.37	0.36	0.20	0.03	0.78
Market access	43	0.17	0.13	0.12	0.04	0.58
Human capital	51	0.37	0.34	0.20	0.05	0.84

Notes: this table reports the original results displayed in Table 3 in Stam et al (2026). We added the column “N”, which now highlights how the number of observations varies considerably across the variables.

Additionally, Table 5 in Stam et al. (2026) mix correlations of ranks and correlations of scores. If the table is truly “between ranks,” the Pearson and Spearman coefficients should be essentially the same; the reported 0.98 versus 0.96 suggests that the Pearson coefficient have been computed on the index scores instead. As written, the title “between ranks” is therefore misleading.

We also examined the reproducibility of Tables 6 and 7 using the materials released by the authors. This exercise shows that these tables are not fully reproducible. For the World Bank new corporation rate, neither the 28-country valid-AEEI sample nor the 27-country published panel reproduces the summary statistics reported in Table 6. Similarly, in Table 7, the AEEI-only specification is reasonably close to the published result, but the GDP-per-capita comparator cannot be replicated because the paper does not identify the underlying GDP series precisely and does not report the regression sample size. Replication is not possible for the Crunchbase- and *Financial Times*/Statista-based outcomes, as these inputs are not released in a form that allows independent reconstruction. Full details are reported in Appendix B.

There are even further empirical inconsistencies. For instance, in Section 4.1, Stam et al (2026) state that the AEEI values “*actually fall within a range of 1.38-4.73.*” However, this contradicts both Table 3, which reports a minimum of 1.66 and a maximum of 4.66, and Table 4, which lists Burkina Faso at 1.66 and Mauritius at 4.66.

Finally, Stam et al (2026) write that “*Both the AEEI and GDP per capita have substantial predictive power, but the former proves superior to the simpler measure. The innovative startup rate is best predicted by the Africa Entrepreneurial Ecosystem Index, followed by the rate of high growth firms and new corporations.*” This sentence is inconsistent with Table 7. For the AEEI, Table 7 reports $R^2= 0.52$ for innovative startup rate, 0.45 for new corporation rate, and 0.38 for high growth firm rate, so new corporation rate is the second-best predicted outcome, rather than high growth firm rate.

3.2 Empirical Biases

Ultimately, it is misleading to label the index presented by Stam et al (2026) an “African” entrepreneurial ecosystem index. For various statistical and methodological reasons that this section outlines, the index as produced is not representative.

The first source of bias is sample selection. The index is compiled for only 27 out of 54 African countries, even though the continent-wide framing of the paper will lead readers to expect broader coverage. As shown in Appendix Table A1 of Stam et al. (2026), the excluded countries are systematically poorer and institutionally weaker than those retained in the final sample. This matters directly for interpretation. Because the normalization procedure is defined relative to the observed sample minima and maxima, the lower bound of the AEEI corresponds to the weakest-performing country among the measurable half of the continent, rather than to a meaningful baseline for Africa as a whole. This issue is even more concerning considering the missing observations for variables such as RD and SMarCap documented in the previous section, which would arguably reduce the sample even further.

The second bias is due to indicator visibility and platform coverage. Several load-bearing inputs in Table 2 are drawn from sources whose coverage is highly contingent on digital penetration, reporting visibility, and platform uptake. For example, the incorporation of LinkedIn users for “professional networks,” Partech venture-capital totals, and outcomes drawn from Crunchbase and the Financial Times in Section 4.2 all carry embedded adoption artifacts.⁴ While Section 3.1 mentions that indicators were screened for external validity, Stam et al. (2026) fails to provide empirical comparability checks, penetration adjustments, or exclusion analyses for these source-specific dynamics. Furthermore, this dynamic introduces a potential shared-source bias into the validation exercise, as the entrepreneurship proxies in Section 4.2 likely reflect the same visibility infrastructure driving the inputs.

A third bias is due to the temporal architecture and indicator timing. Stam et al. (2026) fails to clarify the

⁴ For example, the authors use the Financial Times/Statista data on the fastest growing companies in Africa in Table 7 to evaluate the predictive power of AEEI. This source is not well suited to proxy for the country-level prevalence of fast-growing firms. The FT/Statista rankings are constructed through a combination of outreach based on business databases and public sources, open registration, and submission of verified revenue data by eligible firms, rather than from a census of all firms meeting the underlying growth criteria. This implies a non-random inclusion process that vary across countries with differences in firm visibility, database coverage, participation, and verification. Cross-country variation in FT/Statista counts therefore reflect not only underlying entrepreneurial performance, but also differential inclusion probabilities.

temporal architecture of the index and the specific lag structures intended. Table 2 combines single-year indicators with exceptionally wide multidecade windows: roads cover 2011–2023, literacy is averaged over 2013–2022, tertiary enrolment spans 2018–2022, R&D spans 2010–2022, while other indicators reflect 2021–2023 or 2022 only. Section 4.2 then validates the index against outcomes measured in distinctly separate periods - new corporations in 2020, Crunchbase-founded firms over 2019–2023 measured in 2024, and high-growth firms recorded over 2022–2024. Mixing measurement windows in this manner can dilute genuine relationships or mechanically overstate fit when some inputs operate contemporaneously with the outputs.⁵

A fourth bias is due to construct isolation and macroeconomic variables. Defining market access to include GDP, population, and household final consumption per capita, while incorporating life expectancy into Human Capital (Table 2), structurally binds the AEEI to scale and overall development. Figure 4 reinforces this by displaying how population negatively correlates with various other indicators, suggesting these inputs may function as size or endowment terms, rather than measures of pure ecosystem quality. Indeed, it seems strange to use the size of a country to measure the quality of an entrepreneurial ecosystem.

This becomes an interpretive issue in the analytical "horse race" in Section 4.2 (Table 7) which explores the index's predictive value by comparing the R^2 of the AEEI against GDP per capita. Stam et al (2026) claims, based on this, that the AEEI is "superior" to GDP per capita in predicting productive-entrepreneurship proxies. However, demonstrating that an index containing GDP-related and scale-related inputs outperforms GDP alone, does not provide a clean validation of the distinct ecosystem construct.

This concern is complicated by the fact that GDP per capita is used in Stam et al. (2026)'s Table 7, but not in the construction of the AEEI (see e.g. Figure 3).

A fifth source of bias arises from the interaction between skewed indicators and min–max normalization. Figure 3 shows that several economically important variables, including venture capital, stock-market capitalization, and R&D, are heavily right-skewed. When raw min–max scaling is applied to such distributions, the upper tail can dominate the transformation, compressing most countries into a narrow range near zero. This has important consequences for the index. Dimensions with highly skewed raw variables will end up contributing very little meaningful variation to rank differences across the bulk of countries, even when they are economically central.

A sixth issue concerns pillar weighting and coherence. According to Section 3.1, the culture pillar is measured via two indicators (generalized trust and entrepreneurial personality), and Section 4.1 (Fig. 4–5) reveals that this dimension exhibits negative correlations with several other major indicators and dimensions. Because culture holds equal statistical sway as one of the seven pillars (Section 3.2.2), its inverse empirical behavior will materially shift the overall composite scores for an otherwise well-resourced ecosystem.

⁵ Relatedly, for the R&D variable, sometimes the latest available year is 2021, sometimes it is 2011 (e.g. Cabo Verde). They did not use a deflator, which would be particularly important given the gaps in latest available year. The bias here may be attenuated by the fact that this is measured as R&D/GDP.

Seventh, there is an important aggregation ambiguity concerning the geometric-mean version of the index. It is not possible to obtain a non-null output after taking a geometric mean when one of the inputs is zero. This is because multiplication by zero always yields zero. Their Table 3 reports minimum dimension scores of 0 for *Support* and *Finance*, and under the stated formula a country with any exact zero dimension would have a geometric-mean score of 0. Because Table 4 reports no zero geometric-mean values, it would help to clarify whether the zeros in Table 3 are rounded values or whether the geometric mean was computed after some positive adjustment or transformation.

In conclusion, while it is potentially useful to have a AEEI that is a composite index on the country level across Africa, data limitations mitigate against such a project, as this section has illustrated. The way forward in our view, is the recommendation forwarded by Naudé (2026:138) who argued that “The way forward for entrepreneurial ecosystem index building and monitoring in Africa is not on the country level, but on the sub-national level.” On such a level, new data collection efforts could over time build out the data requirements for better measuring the notion of an “entrepreneurial ecosystem.”

4. Failure to Consider Fundamental Criticisms

Several criticisms raised in prior contributions do not appear to be substantively addressed in Stam et al. (2026). In this respect, they specifically ignore the criticisms that were published by Coad et al. (2026) and Naudé (2024, 2026).

Coad et al., (2026) provide an article-length critique of the theoretical relevance of the EE concept for Africa. Stam et al. (2026) explicitly reject the view advanced by Coad et al. (2026), but provide little substantive engagement with the underlying arguments:

“we reject the view of Coad et al. (2026) that Africa does not need entrepreneurial ecosystem thinking” (Stam et al., 2026, p10)

For instance, Coad et al (2026) pointed to several substantial shortcomings in the AEEI, which were not resolved in the Stam et al (2026) paper, such as ongoing conceptual confusion (see also Harrison, 2026). Stam et al. (2026) fails to provide a clear definition of an Entrepreneurial Ecosystem (EE). They fail to clarify the existing confusion in the literature (e.g. Harrison, 2026) regarding how EEs are sector-agnostic rather than sector-specific (they discuss the sector-specific concept of "digital EEs"), and they introduce confusion about whether the EE output includes solo entrepreneurs.

This conceptual confusion is already visible in the second sentence of Stam et al (2026):

“What Africa needs is not more self-employed without employees (cf. Coad et al., 2026; Mandelman & Montes-Rojas, 2009), but more productive entrepreneurship, entrepreneurial activity “that contributes directly or indirectly to the net output of the economy or to the capacity to produce additional output” (Baumol, 1993, p.30).”

However, Baumol (1993) does not suggest there is any tension between productive entrepreneurship and the self-employed without employees (SEWNEs). Many SEWNEs are honest, hard-working individuals that indeed contribute “directly or indirectly to the net output of the economy or to the capacity to produce additional output” (Baumol, 1993, p.30). Excluding SEWNEs from the category of productive entrepreneurship risks implying an unduly narrow interpretation of Baumol’s concept. Many self-employed workers without employees may contribute directly or indirectly to net output, and recent work similarly emphasizes their role in contemporary economies (see, e.g., Burke and Cowling, 2020).**5.**

5. Textual Overlap, Misrepresentations and Attribution Concerns

The AEEI was first made public via a website in 2024 and was subsequently criticized by Naudé (2024, 2026). The later *World Development* article by Stam et al. (2026) appeared after these earlier critiques. This chronology matters because some passages and methodological choices in the published article overlap closely with points previously made by Naudé (2024, 2026). In this section, we document these overlaps and discuss why clearer attribution and engagement with prior criticism would have been important for readers seeking to understand the development of the AEEI and the debate surrounding it.

Table 6 documents these similarities.

Table 6: Verbatim text lifting in Stam et al

Naudé (2024; 2026) / published online April 2025	Stam et al (2026)
“Simply aggregating the component values in a linear fashion, the authors impose a compensatory aggregation. This means that each indicator is treated as a potential substitute for the other... A solution is to use a geometric aggregation.” (p.10)	“Simply aggregating the values of the seven dimensions in a linear fashion imposes a compensatory aggregation. This means that each dimension is treated as a potential substitute for the other... A solution is to use a geometric aggregation.” (p.8)

When Stam et al. (2026) do cite the Naudé (2024, 2026) paper, the citation does not make clear that the referenced paper is a direct and systematic critique of the AEEI itself. They cite Naudé (2026) only once, as an example of standard "*applications in the entrepreneurial ecosystem literature*", sandwiched between a set of other general methodological papers that are predominantly self-citations. This does not make clear that Naude's paper is not a general application, but a direct, systematic critique of their own AEEI. The full title of Naudé’s (2024, 2026) paper, which is listed in Stam et al.'s own references, is "*The African entrepreneurial ecosystem index: Conceptual, methodological and empirical flaws and the way forward*". Citing a paper dedicated to evaluating limitations of the index as if it were simply a supportive methodological text will leave readers with a misleading impression of its role in the literature.

A related attribution issue concerns the introduction of the geometric-mean aggregation as a robustness check. In his critical evaluation of the African Entrepreneurial Ecosystem Index (AEEI) that was issued online in 2024⁶ (at <https://africa.ecosystem.build/> - see AEEI (2024) - Naudé (2024, 2026) explicitly pointed out that the linear aggregation method then used was problematic and proposed calculating a geometric mean index as a robustness check. Naudé (2024, 2026) went on to perform this calculation, presenting the geometric means and comparing the rankings in his paper's tables.

In their subsequent updates and SSRN working paper and later *World Development* paper, Stam et al. (2026) introduce this exact same geometric mean aggregation as a robustness check for the AEEI (Table 4) and use the exact same logic to justify it, yet they do not explicitly credit Naudé (2024, 2026) for identifying the issue and proposing this specific methodological approach.

The attribution issue is reinforced by the fact that Stam et al. (2026) cite Mazziotta and Pareto to justify the geometric-mean specification. In fact, this work was first cited by Naudé (2024, 2026) to support his use of the geometric mean to reduce outliers. This allows Stam et al. (2026) to bypass crediting Naudé (2024, 2026) for identifying the specific issue in the AEEI.

6. Concluding Remarks

Research into Entrepreneurial Ecosystems is experiencing explosive growth in recent years, with some scholars wondering whether this is just a passing fad (Brown and Mawson, 2019) and others noting that entrepreneurship research is declining in terms of impact, reflecting that the growth in fads may rather be scholarship going around in circles, rather than generating impactful insights (Naudé, 2025). Alongside this fad of entrepreneurial ecosystems research, there are also several papers emerging that find methodological errors in empirical EE research published in leading journals (Coad and Srhoj, 2023, 2025; Du et al., 2026; Naudé, 2026).

Against this backdrop, this paper evaluated the recent Africa Entrepreneurial Ecosystem Index (AEEI) proposed by Stam et al. (2026). We documented a range of technical, empirical, and reproducibility concerns that limit confidence in the AEEI as a comparative measure of entrepreneurial ecosystems in Africa. These concerns only fuel the growing discomfort with the notion and application of the concept of entrepreneurial ecosystems that are growing in some scholarly circles.

Given the evidence to support these conclusions that was provided in this paper, policymakers and scholars should therefore treat the index with caution, since its use risks misinforming economic, institutional, and development strategies, and undermines genuine entrepreneurship scholarship.

⁶ The original AEEI methodology and Excel data file was subsequently removed from the website (<https://africa.ecosystem.build/>) but is available from the authors on request.

Acknowledgements

The views expressed are those of the authors and do not necessarily reflect an official position of the European Commission. All remaining errors remain our own.

References

- AEEI (2024). The African Entrepreneurial Ecosystem Index : Data and Methodology. April. Downloaded on 7 June 2024 from https://africa.ecosystem.build/wp-content/uploads/2024/04/AEEI_data_methodology_april_2024.pdf (File subsequently removed).
- Alvedalen, J. and Boschma, R. (2017). A critical review of entrepreneurial ecosystems research: towards a future research agenda, *European Planning Studies*, 25(6): 887-903. <https://doi.org/10.1080/09654313.2017.1299694>
- Baumol, W. (1993). *Entrepreneurship, Management and the Structure of Payoffs*. London: MIT Press.
- Brown, R., and Mawson, S. (2019). Entrepreneurial ecosystems and public policy in action: a critique of the latest industrial policy blockbuster. *Cambridge Journal of Regions, Economy and Society*, 12(3), 347-368.
- Burke, A., and Cowling, M. (2020). On the critical role of freelancers in agile economies, *Small Business Economics*, 55(2),: 393-398.
- Coad, A., Domnick, C., Santoleri, P. and Srhoj, S. (2026). Does Africa need entrepreneurial ecosystems thinking? *Journal of Technology Transfer*, 51: 145-171. <https://doi.org/10.1007/s10961-025-10213-x>
- Coad, A., and Srhoj, S. (2023). Entrepreneurial ecosystems and regional persistence of high growth firms: A ‘broken clock’ critique. *Research Policy*, 52(6), 104762. <https://doi.org/10.1016/j.respol.2023.104762>
- Coad A., Srhoj S., (2025). "Entrepreneurial ecosystems and the persistence of regional high-growth firm shares: A reply to van Dijk, Leendertse, Stam, and van Rijnsoever (2025)." *Research Policy*, forthcoming. <https://doi.org/10.1016/j.respol.2025.105325>
- Du, J., Karoglou, M., Ri, A., and Zhang, L. (2025). Knowledge spillovers, entrepreneurial ecosystems and the geography of high growth firms redux. *Journal of Technology Transfer*, 1-64. <https://doi.org/10.1007/s10961-025-10210-0>
- Harrison R. T. (2026). “Close enough to speak; distant enough to learn?” Theory and the epistemology and ontology of the entrepreneurial ecosystem metaphor. *Journal of Technology Transfer*, 51, 11–33. <https://doi.org/10.1007/s10961-025-10206-w>
- Naudé, W. (2024). The African Entrepreneurial Ecosystem Index: Conceptual, Methodological and Empirical Flaws and the Way Forward. *IZA Discussion Paper, 17075*. Bonn: IZA Institute of Labor Economics.
- Naudé, W. (2025) Business and entrepreneurship is declining as scholarly field: Empirical evidence. *PLOS ONE*, 20(5): e0323297. <https://doi.org/10.1371/journal.pone.0323297>
- Naudé, W. (2026). The African entrepreneurial ecosystem index: conceptual, methodological and empirical flaws and the way forward. *Journal of Technology Transfer*, 51: 125-144. <https://doi.org/10.1007/s10961-025-10208-8>

Stam, E., Nkontwana, P., McDonald, R., Murenzi, R., Addo, K. A., Bayuo, B., Baah B., Riezebos S., Gelissen, T. (2025). Measuring National Entrepreneurial Ecosystems in Africa. Available at SSRN: <https://ssrn.com/abstract=5254687> or <http://dx.doi.org/10.2139/ssrn.5254687>; posted 19 May 2025, last revised 9 Aug 2025.

Stam, E., Nkontwana, P., McDonald, R., Murenzi, R. , Addo, K.A., Bayuo, B., Baah, B., Riezebos, S. and Gelissen, T. (2026). Measuring national entrepreneurial ecosystems in Africa, *World Development*, 202: 107357 <https://doi.org/10.1016/j.worlddev.2026.107357>

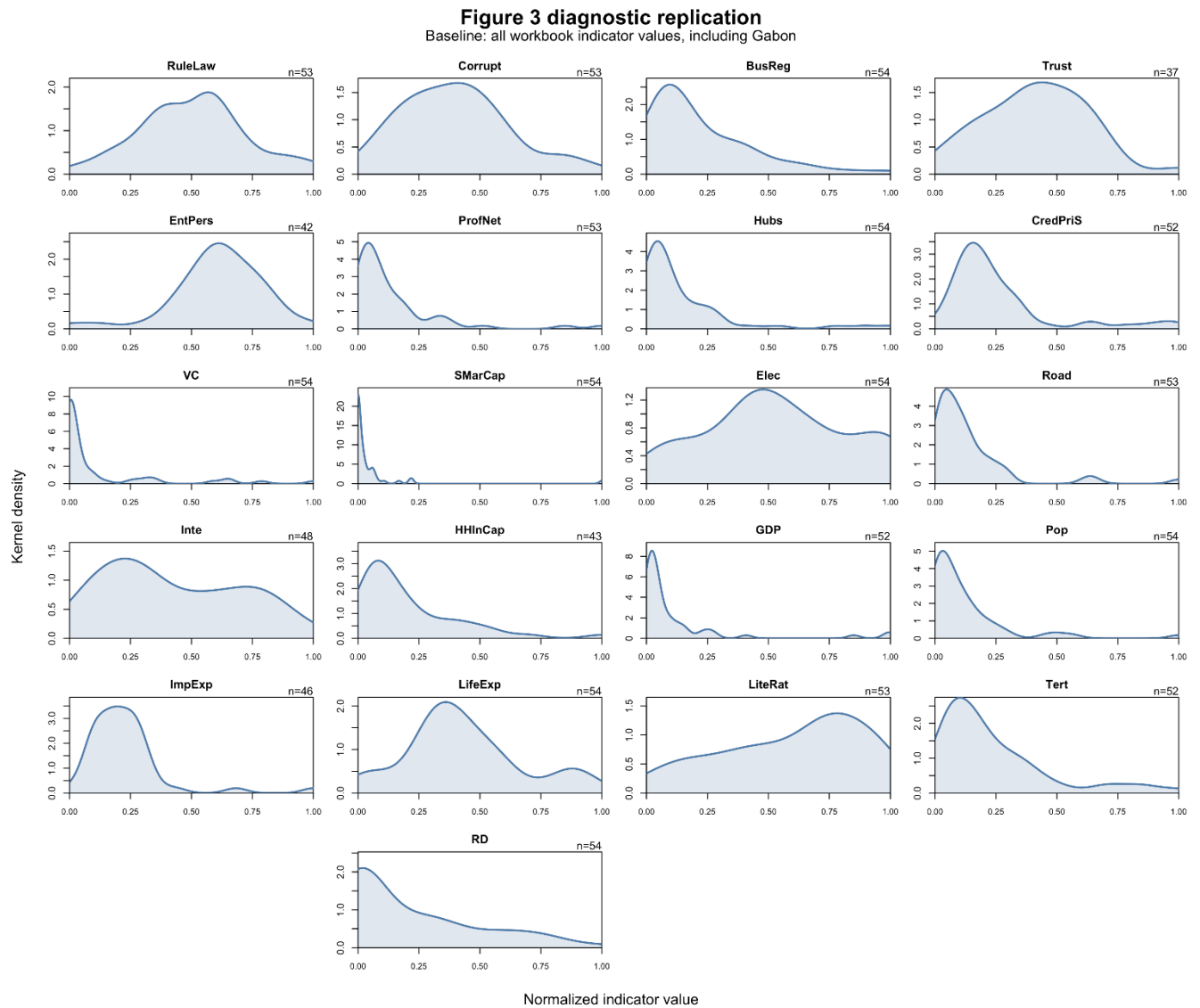
Appendix

Here we report additional evidence concerning our replication exercise based on the data publicly released from the authors.

A. Reproducing Figure 3

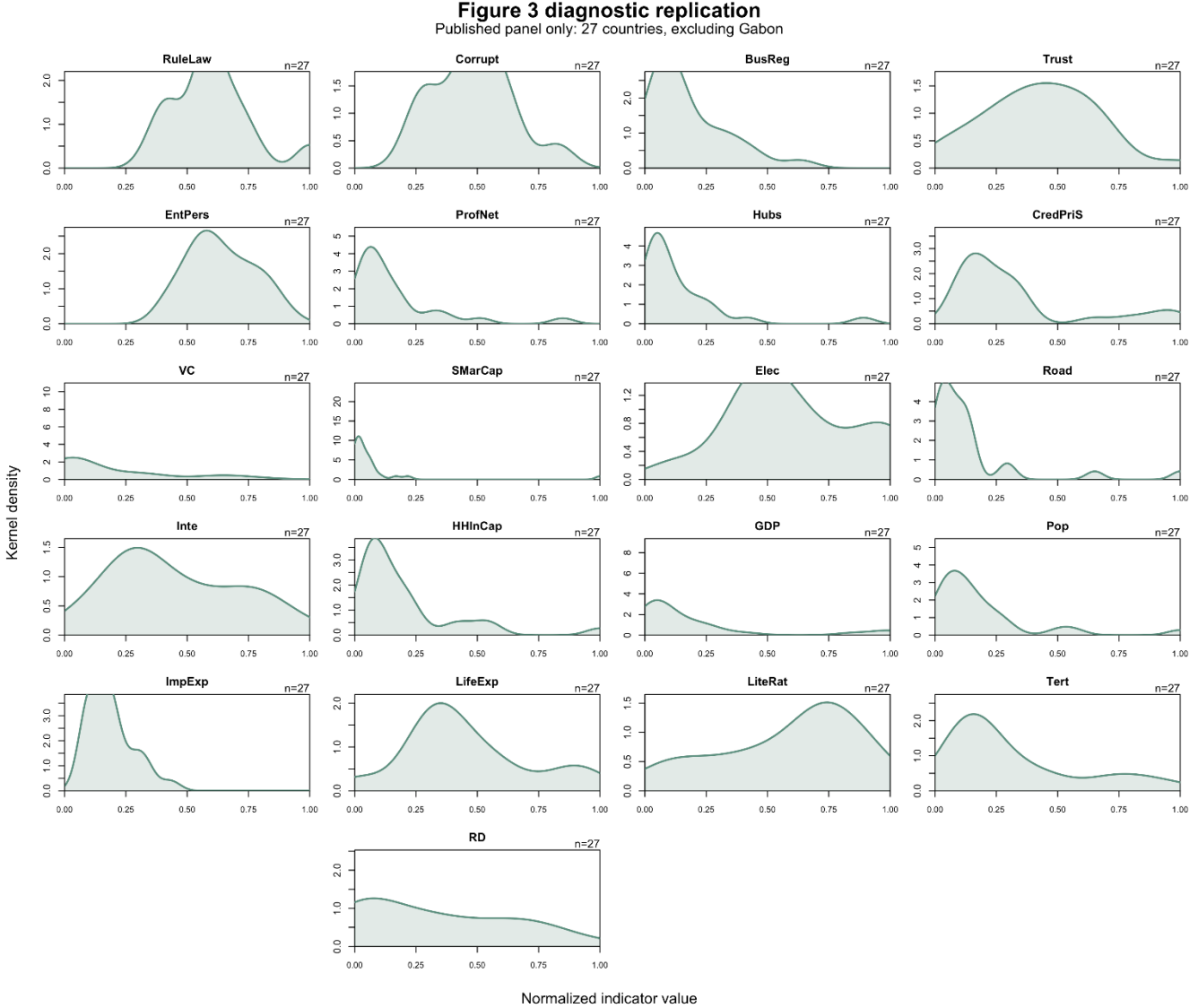
We replicate Figure 3 in Stam et al. (2026) and add the number of observations used for each variable. The plot published in the paper features several observations that vary depending on the variable (see Figure A1).

Figure A1: Replicating Figure 3



Once the figure is restricted to the paper's final 27-country panel, the distributions are often visibly different. This is the more appropriate descriptive sample if Figure 3 is meant to characterize the countries that enter the published index ranking.

Figure A2: Replicating Figure 3 using the final sample

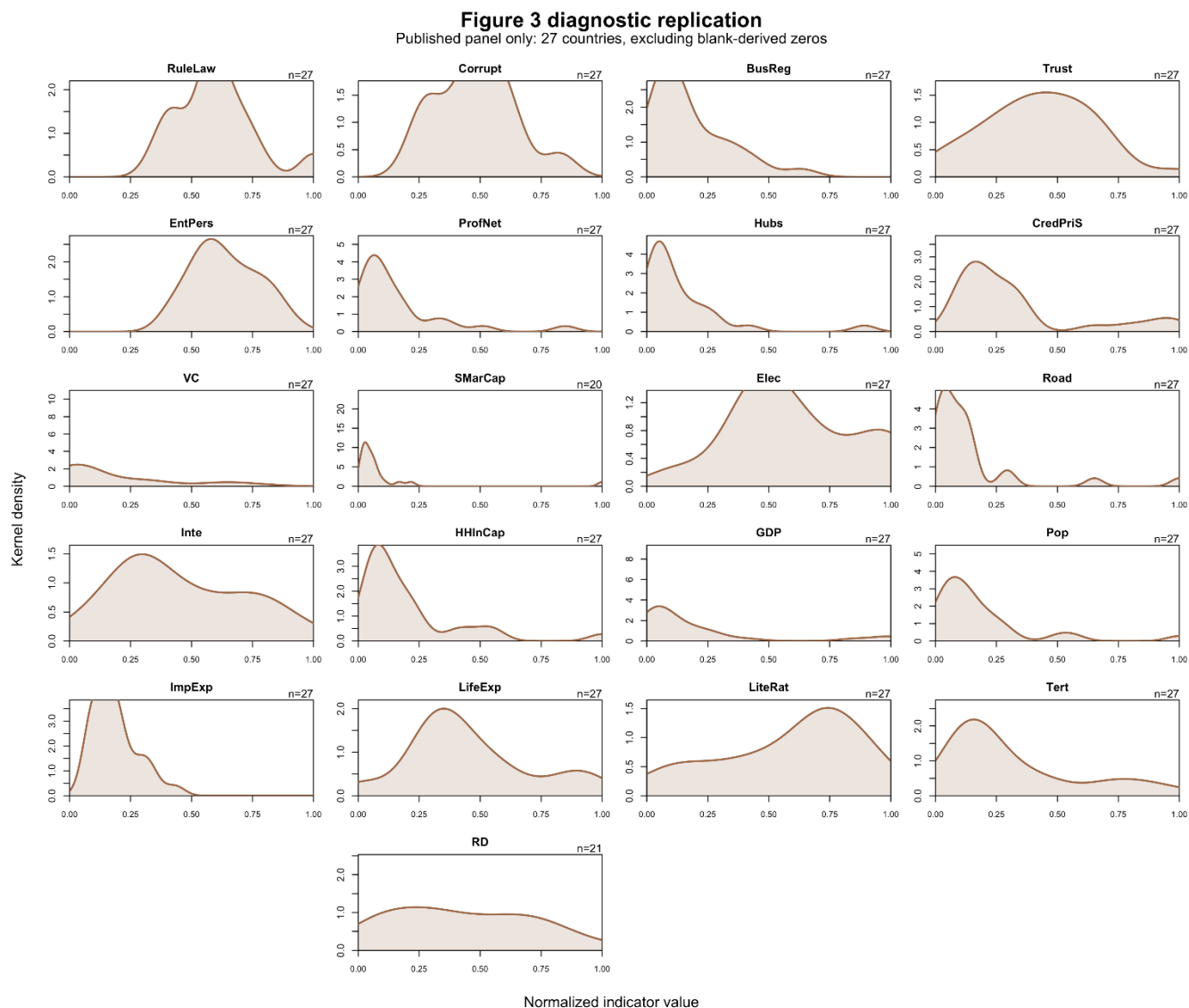


The differences become much larger once clearly blank-derived zeros are removed. The original data included in the Excel file show that the RD and SMarCap variables are heavily affected by blank cells that were arguably converted into zeros before normalization. In the 27-country panel:

- SMarCap falls from 27 observations to 20 once clearly blank-derived zeros are removed
- RD falls from 27 observations to 21 once clearly blank-derived zeros are removed

Those are large sample changes in a 27-country figure, and they visibly alter the kernel densities for the affected indicators as can be observed in Figure A3.

Figure A3: Replicating Figure 3 discarding imputed zeros



The broader implication is that Figure 3 is not reproducible because the paper does not state which sample the panels are meant to describe. Ideally, the distributions to be presented concern the final sample of countries for which all variables are non-missing. Finally, and most importantly, the imputed zeros for some variables materially change the sample and displayed distributions for at least two indicators.

B. Limited reproducibility of Tables 6 and 7

Tables 6 and 7 are not fully reproducible from the materials released with the paper. The analysis in these tables relies on three entrepreneurship outcome measures: the new corporation rate from the World Bank, the innovative startup rate from Crunchbase, and the high-growth firm rate from the *Financial Times*/Statista rankings. Of these, only the World Bank component is directly accessible and testable in a reproducible way using public data and the information reported in the paper.

For the World Bank outcome, the paper defines the new corporation rate as series IC.BUS.NDNS.ZS, corresponding to the density of newly registered firms per 1,000 working-age people in 2020. By contrast, the GDP variable used in Table 7 is insufficiently documented. Table 7 labels the variable only as *GDP per Capita (2018–2022, constant)*, without identifying the underlying World Bank series code, the PPP convention, or the base-year convention. In addition, the GDP indicator used elsewhere in the index documentation is itself ambiguous: Table 2 lists source code NY.GDP.MKTP.KD, which refers to GDP in constant 2015 U.S. dollars, while the accompanying description states that the data are in *current U.S. dollars*. This internal inconsistency makes it difficult to infer a unique GDP-per-capita series for replication purposes.

For that reason, we do not impose a single interpretation of the intended GDP comparator. Instead, we test the two most plausible World Bank candidates: NY.GDP.PCAP.KD and NY.GDP.PCAP.PP.KD. We also consider two plausible country samples, because the paper does not clearly state whether Tables 6 and 7 are based on the underlying valid-AEEI sample or on the published 27-country ranking panel. The first sample is the 28-country valid-AEEI sample, corresponding to the underlying complete-case AEEI score table. The second is the 27-country published panel, corresponding to the ranking reported in the paper, which omits Gabon.

Neither sample rule reproduces the published table exactly. On the 28-country valid-AEEI sample with observed 2020 values only, we obtain $N = 20$, mean = 1.96, median = 0.99, and $SD = 2.94$. On the 27-country published panel with observed 2020 values only, we obtain $N = 19$, mean = 2.02, median = 0.99, and $SD = 3.01$. These values differ materially from those reported in the paper (mean = 1.52, median = 0.33, $SD = 3.45$). Restricting the sample to either of the two most defensible AEEI-based country sets therefore does not resolve the discrepancy.

Table A1. Replication of Table 6 using the World Bank new corporation rate

Statistic	Paper	28-country sample	27-country sample
N	not reported	20	19
Mean	1.52	1.96	2.02
Median	0.33	0.99	0.99
SD	3.45	2.94	3.01

Note: The paper defines the outcome as the World Bank new corporation rate, series IC.BUS.NDNS.ZS, for 2020. Replication results are reported for two transparent observed-value sample rules: the 28-country valid-AEEI sample and the 27-country published ranking panel. Neither reproduces the published moments exactly.

A key obstacle to replication is that the paper does not report the number of observations underlying Table 6. As a result, an independent researcher cannot verify which country sample the published moments are intended to summarize. Even when one uses the exact World Bank outcome definition reported by the authors, Table 6 cannot be reconstructed from the released materials.

Table 7 shows a similar pattern. Using the exact paper outcome definition, the same two observed-value sample rules, and both GDP-per-capita candidates, we estimate the simple horse-race specifications. The AEEI-only specification partially replicates: the reproduced R-squared is 0.423 on both observed-value samples, which is reasonably close to the paper’s reported value of 0.45. However, the GDP specifications do not line up cleanly under either candidate series. The PPP-based series gets somewhat closer to the paper in some cells, but no single combination of GDP series and country sample reproduces the published pattern.

Table A2. Replication of Table 7 using alternative World Bank GDP-per-capita series

Panel A. Original Table 7 as reported in the paper

Specification	N	R ²
AEEI only	not reported	0.45
GDP per Capita (2018–2022, constant)	not reported	0.24
log GDP per Capita (2018–2022, constant)	not reported	0.24

Panel B. Replication using NY.GDP.PCAP.KD

Specification	N 28-country	R ² 28-country	N 27-country	R ² 27-country
AEEI only	20	0.423	19	0.423
GDP per Capita (2018–2022, constant)	20	0.329	19	0.421
log GDP per Capita (2018–2022, constant)	20	0.254	19	0.326

Panel C. Replication using NY.GDP.PCAP.PP.KD

Specification	N 28-country	R ² 28-country	N 27-country	R ² 27-country
AEEI only	20	0.423	19	0.423
GDP per Capita (2018–2022, constant)	20	0.193	19	0.267
log GDP per Capita (2018–2022, constant)	20	0.170	19	0.224

Note: Because the paper does not identify the exact GDP-per-capita series used in Table 7, we replicate the regressions using two plausible World Bank candidates: NY.GDP.PCAP.KD and NY.GDP.PCAP.PP.KD. Results are shown for both the 28-country valid-AEEI sample and the 27-country published ranking panel.

Replication is again not possible due to the absence of the regression sample size in the published table. Without the number of observations, it is impossible to determine whether the intended estimation sample corresponds to the 28-country complete-case AEEI sample, the published 27-country panel, or some other intersection with the external data. A further complication is that the World Bank variable is not exactly reported and that World Bank GDP series may be revised over time, so even a correctly identified series might not reproduce exactly the vintage used by the authors.

Taken together, the most accessible part of Table 7 only partially replicates. The AEEI column is directionally close, **but the GDP columns cannot be reproduced from the paper's documentation.** The remaining outcome measures in Tables 6 and 7 are even less reproducible. The Crunchbase-derived and *Financial Times*/Statista-derived country-level inputs are not released in the replication package and cannot be fully reconstructed from publicly accessible materials alone. For that reason, Tables 6 and 7 are not fully independently reproducible from the released materials.