


The background of the cover is a vibrant collage of circular images. These images depict various industrial and infrastructure scenes: an airplane on a tarmac, a worker on a forklift in a warehouse, a power transmission tower, a large industrial facility with cranes, a modern building interior, a worker in a yellow safety suit, and a data visualization with charts and numbers. The overall color palette is dominated by blues, greens, and yellows, with a grid-like pattern overlaid on the bottom half.

# IsDB GROUP TECHNICAL REPORT ON THE CONSTRUCTION OF THE IsDB INTEGRATION INDEX 2022



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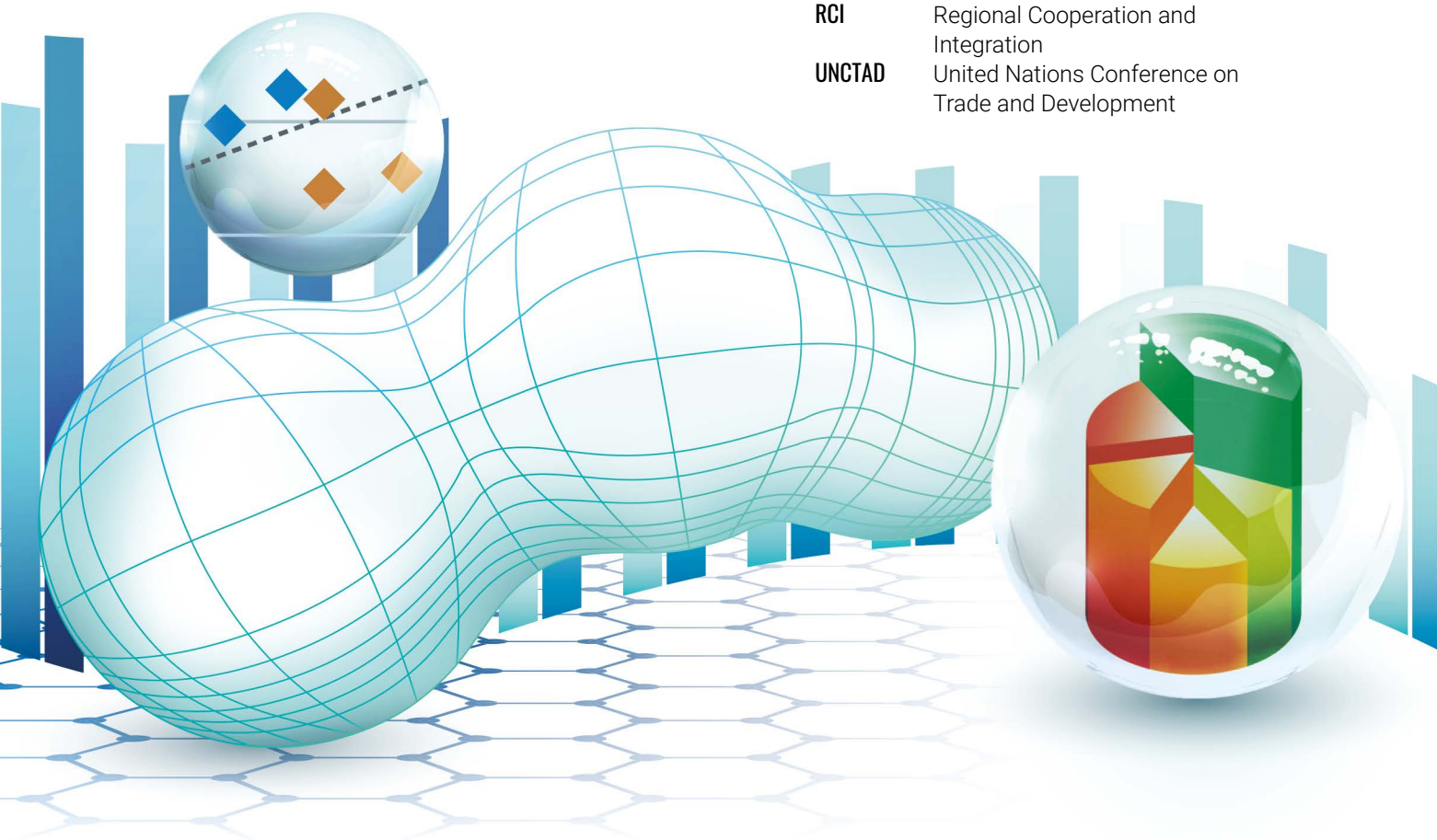
IsDB GROUP  
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2022

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# ACRONYMS AND ABBREVIATIONS

<b>ADB</b>	Asian Development Bank
<b>AfDB</b>	African Development Bank
<b>ARCI</b>	Asia-Pacific Regional Cooperation and Integration Index
<b>ARII</b>	Africa Regional Integration Index
<b>BEC</b>	Broad Economic Categories
<b>ERS</b>	Economic Research and Statistics
<b>FDI</b>	Foreign Direct Investment
<b>FTA</b>	Free Trade Agreement
<b>ICD</b>	Islamic Corporation for the Development of the Private Sector
<b>ICIEC</b>	Islamic Corporation for the Insurance of Investment and Export Credit
<b>IMF</b>	International Monetary Fund
<b>IsDB</b>	Islamic Development Bank
<b>IsDBI</b>	Islamic Development Bank Institute
<b>ITFC</b>	International Islamic Trade Finance Corporation
<b>KMO</b>	Kaiser-Meyer-Olkin (statistical test)
<b>MC</b>	Member Country
<b>MENA</b>	Middle East and North Africa
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>PCA</b>	Principal Component Analysis
<b>RCI</b>	Regional Cooperation and Integration
<b>UNCTAD</b>	United Nations Conference on Trade and Development



# INTRODUCTION



Measuring the level of economic and regional integration within a group of economies requires the use of several statistical tools because it is a multi-faceted concept with several dimensions. As the process of economic integration enables countries to facilitate the flow of goods, services, capital and people, it has a key role in promoting the economic growth of individual countries and enhancing their resilience jointly as a group.

Several efforts have been made to better understand the concept of economic integration to undertake comparative research and policy studies on a regional basis. For example, the Asian Development Bank (ADB) has developed the Asia-Pacific Regional Cooperation and Integration Index (ARCII), which is a composite index providing a multidimensional measure of regional integration. The index allows for tracking progress on a set of relevant dimensions of regional integration, identifying strengths and weaknesses at the regional, sub-regional and national levels. Similarly, the African Union Commission, United Nations Economic Commission for Africa and the African Development Bank have jointly initiated the Africa Regional Integration Index (ARII) platform, which allows the user to access ARII scores and rankings as well as the data used to compute these scores and a vast array of related information. The index covers various dimensions of regional integration: trade, production networks, macroeconomy, infrastructure and free movement of people.

The Islamic Development Bank (IsDB) Integration Index is constructed as a composite index that represents the five main dimensions of economic integration, namely, Trade and Investment Integration, Financial Markets Integration, Production Networks, Connectivity and Logistics,

**The main objective of this report is to explain the process of constructing the IsDB Integration Index and provide detailed technical information about its methodology and results.**

and Human Mobility & Institutional Integration (please see table A6 for comparison of the three indices).

The process of building the IsDB Integration Index was composed of five steps. First is the selection of the input indicators under each specific dimension of economic integration based on literature review results. The second step involves investigating the data sources and their credibility and availability. Third is the review of the methodology for calculating each specific input indicator (i.e., transforming the raw data into input indicators). After that, relevant normalization and interpolation techniques were used to make the set of indicators harmonized for the last step of the process. Finally, the principal components analysis (PCA) technique was applied to the final dataset to get the results.

The main objective of this report is to explain the process of constructing the IsDB Integration Index and provide detailed technical information about its methodology and results. The technical report is organized as follows. Section II introduces a literature review of similar studies. Section III presents the set of indicators under each specific dimension of economic integration. Data sources are provided in Section IV. The sections after provide additional information about methodological details, empirical results, and robustness checks before the conclusion.



# LITERATURE REVIEW



In developing composite indices of economic integration, principal component analysis (PCA) is a widely used statistical technique to determine the weights of each criterion in an objective way. The idea under PCA is to account for the highest possible variation in the indicator set using the smallest possible number of factors. It groups individual indicators which are collinear to form a composite indicator that captures as much as possible of the information common to individual indicators.<sup>1</sup> This ensures the most optimal use of existing data based on its correlation structure.

The PCA technique reduces the dimensionality of the data by transforming the original data set to a new set of variables called principal components. The components reflect both common and unique variance of the variables, with the last few components identifying directions in which there is negligible variation or a near linear relationship with the original variables. Thus, PCA reduces the number of variables under examination and allows one to detect and recognize groups of interrelated variables. The technique was first introduced in 1901 by Karl Pearson and subsequently modified three decades later by Harold Hotelling to explore correlation structures.<sup>2</sup>

In composite indices, the selection of a weighting procedure and the assignment of weights to variables directly affect the results. Therefore, selecting an appropriate weighting procedure is fundamental to the successful construction of a composite indicator. In order not to introduce a bias to such index results, it is recommended to avoid a priori weighting procedures.<sup>3</sup> Thus, in designing a composite index, PCA is considered as a viable tool to determine the weights of indicators in an objective way on statistical grounds. In addition to objectivity, due to its straightforward application, PCA has been applied to develop many kinds of indices, including those related to measuring welfare, socioeconomic development, and regional integration. However, there are some caveats to consider. PCA can be very sensitive to the inclusion or exclusion of new indicators. For inter-temporal comparison purposes, it is advisable to consistently use the same set of variables when recalculating the composite index as new data becomes available.

PCA has already been used extensively in constructing composite economic integration indices. In 2017, the Asian Development Bank (ADB) developed the Asia-Pacific Regional Integration Index to measure the degree of regional integration in Asia and the Pacific. This index adopts PCA to decide on the weights of various regional integration dimensions and indicators.<sup>4</sup> The extended index is based on 41 indicators that measure different aspects of regional integration across eight dimensions, namely, trade and investment, money and finance, regional value chains, infrastructure and connectivity, free movement of people, institutional and social integration, technology and digital connectivity, and environmental cooperation.

Before the launch of the Asia-Pacific Regional Integration Index, back in 2016, the African Union (AU) Commission, the African Development Bank (AfDB) and the UN Economic Commission for Africa (UNECA) published the first edition of the Africa Regional Integration Index. This study adopted an arithmetic average to construct dimensional and overall indexes whereby all components are weighted equally in the aggregation. Later, in 2019, the next edition of the Africa Regional Integration Index employed PCA to assign weights to both individual indicators and dimensions.<sup>5</sup> The 2019 index is composed of 16 indicators grouped into five dimensions, namely, trade, productive, macroeconomic, infrastructural and free movement of people dimensions.

Following the spirit of similar index studies, IsDB's integration index follows a two-step PCA method as a weighting procedure. The estimates are produced by applying the first PCA to each dimension and then a second PCA for the overall index. So, the first PCA assigns weights to individual indicators within each dimension, and the second PCA generates the weights for the dimensions of the composite index.

<sup>1</sup> OECD and EC-JRC. (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing.

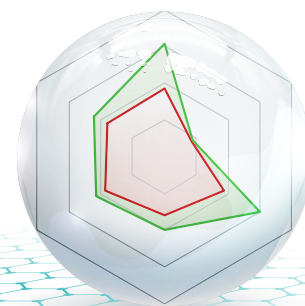
<sup>2</sup> Salkind, N. J. (Ed.). (2010). *Encyclopedia of Research Design* (Vol. 1). Sage.

<sup>3</sup> König, J. (2015). *The EU Index of Integration Effort*. UNU-CRIS Working Papers.

<sup>4</sup> Huh, H. S., and Park, C. Y. (2018). *Asia-Pacific Regional Integration Index: Construction, Interpretation and Comparison*. ADB.

<sup>5</sup> AU, AfDB, and UNECA. (2019). *Africa Regional Integration Index: Methodological Note*.

# DIMENSIONS AND INDICATORS OF THE IsDB INTEGRATION INDEX



The IsDB Integration Index is composed of 21 indicators that are grouped under five main dimensions as follows:

- **DIMENSION 1: TRADE AND INVESTMENT INTEGRATION**
- **DIMENSION 2: FINANCIAL MARKETS INTEGRATION**
- **DIMENSION 3: PRODUCTION NETWORKS**
- **DIMENSION 4: CONNECTIVITY AND LOGISTICS**
- **DIMENSION 5: HUMAN MOBILITY AND INSTITUTIONAL INTEGRATION**

The Trade and Investment Integration dimension consists of four input indicators, namely, the ratio of intra-IsDB exports to total exports, the ratio of intra-IsDB imports to total imports, the ratio of intra-IsDB international trade to total international trade, and the ratio of intra-IsDB FDI inflows to total FDI inflows. These indicators express the trade flows, both imports and exports, between IsDB member countries (MCs) in comparison to the world. The last two indicators reflect the investment flows between IsDB MCs.

The Financial Markets Integration dimension consists of four input indicators, namely, the ratio of intra-IsDB cross-border equity liabilities to total cross-border equity liabilities, the ratio of intra-IsDB cross-border bond liabilities to total cross-border bond liabilities, financial institutions depth index, and finally, financial markets depth index.

The third dimension of the IsDB Integration Index, Production Networks, consists of four input indicators. The average trade complementarity index over the IsDB trading partners indicator and the average trade concentration index over the IsDB trading partners indicator reflect the complementarity and centrality of trade among IsDB MCs. The other two indicators, namely, the ratio of intra-IsDB intermediate goods exports to total intra-IsDB goods exports and the ratio of intra-IsDB intermediate goods imports to total intra-IsDB goods imports indicators reflect the level of production-related forward and backward linkages between IsDB MCs. It is worth mentioning that intermediate goods are considered based on their definition as the sum of the following categories in the United Nations Comtrade Broad Economic Categories (BEC) codes.

- 111\* Food and beverages, primary, mainly for industry
- 121\* Food and beverages, processed, mainly for industry
- 21\* Industrial supplies not elsewhere specified, primary
- 22\* Industrial supplies not elsewhere specified, processed
- 31\* Fuels and lubricants, primary
- 322\* Fuels and lubricants, processed (other than motor spirit)
- 42\* Parts and accessories of capital goods (except transport equipment)
- 53\* Parts and accessories of transport equipment.

It is calculated for the Country  $x_{it}$  intermediate exports/imports to other IsDB MCs divided by the country  $x_{it}$  total exports to IsDB MCs total exports/imports, where country  $x_i$  points out to specific country and  $t$  for the year.

The Connectivity and Logistics dimension comprises four input indicators: the average trade cost over IsDB trading partners, the average liner shipping connectivity index over IsDB trading partners, logistics performance index (overall), and fixed broadband subscriptions per 100 people.

Finally, the Human Mobility and Institutional Integration dimension consists of five input indicators. The first two indicators reflect the free mobility of people between the IsDB MCs. These are the share of other IsDB MCs that do not require an entry visa and the ratio of intra-IsDB migrant stock to total migrant stock. The remaining three indicators represent the institutional integration sub-dimension, comprising the share of other IsDB MCs that have an embassy, the share of other IsDB MCs that have signed Free Trade Agreements, and finally, the share of other IsDB MCs that have signed business investment treaties.

Most of the input indicators used in constructing the index are based on bilateral data since regional (country grouping-based) economic integration is expressed as a ratio of the intraregional sum (or average) to total sum (or average) of cross-border economic activity. There are some exceptions, as seen in the examples of the logistics performance index (overall) and fixed broadband subscriptions (per 100 people), where only the value of the index is taken for comparison. Those indicators only reflect national levels due to data availability. The indicators used in constructing the IsDB Integration Index are drawn from annual data from 2010 to 2020.

# DATA SOURCES



The table below presents the sources for each indicator included in the index.

**TABLE 1 DATA SOURCES**

DIMENSION	INDICATOR CODE	INDICATOR NAME	DATA SOURCES
I. TRADE AND INVESTMENT INTEGRATION	I-a	Ratio of intra-IsDB exports to total exports	International Monetary Fund (IMF). Direction of Trade Statistics. <a href="http://www.imf.org/en/Data">www.imf.org/en/Data</a>
	I-b	Ratio of intra-IsDB imports to total imports	International Monetary Fund (IMF). Direction of Trade Statistics. <a href="http://www.imf.org/en/Data">www.imf.org/en/Data</a>
	I-c	Ratio of intra-IsDB international trade to total international trade	International Monetary Fund (IMF). Direction of Trade Statistics. <a href="http://www.imf.org/en/Data">www.imf.org/en/Data</a>
	I-d	Ratio of intra-IsDB FDI inflows to total FDI inflows	Orbis Cross-Border Investments Database
II. FINANCIAL MARKETS INTEGRATION	II-a	Ratio of intra-IsDB cross-border equity liabilities to total cross-border equity liabilities	IMF Coordinated Portfolio Investment Survey
	II-b	Ratio of intra-IsDB cross-border bond liabilities to total cross-border bond liabilities	IMF Coordinated Portfolio Investment Survey
	II-c	Financial institutions depth index	IMF Financial Development Index Database
	II-d	Financial markets depth index	IMF Financial Development Index Database
III. PRODUCTION NETWORKS	III-a	Average trade complementarity index over IsDB trading partners	United Nations Conference on Trade and Development (UNCTAD). UNCTADstat. <a href="http://unctadstat.unctad.org/EN/">http://unctadstat.unctad.org/EN/</a>
	III-b	Average trade concentration index over IsDB trading partners	United Nations Conference on Trade and Development (UNCTAD). UNCTADstat. <a href="http://unctadstat.unctad.org/EN/">http://unctadstat.unctad.org/EN/</a>
	III-c	Ratio of intra-IsDB intermediate goods exports to total intra-IsDB goods exports	United Nations. Commodity Trade Database. <a href="https://comtrade.un.org/">https://comtrade.un.org/</a>
	III-d	Ratio of intra-IsDB intermediate goods imports to total intra-IsDB goods imports	United Nations. Commodity Trade Database. <a href="https://comtrade.un.org/">https://comtrade.un.org/</a>
IV. CONNECTIVITY AND LOGISTICS	IV-a	Average trade cost over IsDB trading partners	World Bank and United Nations Economic and Social Commission for Asia and the Pacific. Trade Costs Database. <a href="http://www.databank.worldbank.org">www.databank.worldbank.org</a>
	IV-b	Average liner shipping connectivity index over IsDB trading partners	UNCTAD. UNCTADstat. <a href="http://unctadstat.unctad.org/EN/">http://unctadstat.unctad.org/EN/</a>
	IV-c	Logistics performance index (overall)	World Bank. Logistics Performance Index. <a href="http://lpi.worldbank.org">http://lpi.worldbank.org</a>
	IV-d	Fixed broadband subscriptions (per 100 people)	World Bank – World Development Indicators <a href="http://databank.worldbank.org">http://databank.worldbank.org</a>
V. HUMAN MOBILITY AND INSTITUTIONAL INTEGRATION	V-a	Share of other IsDB MCs that do not require an entry visa	Henley & Partners. <a href="https://www.henleyglobal.com/">https://www.henleyglobal.com/</a>
	V-b	Ratio of intra-IsDB migrant stock to total migrant stock	United Nations. Department of Economic and Social Affairs, Population Division. International Migration Stock
	V-c	Share of other IsDB MCs that have an embassy	<a href="https://www.embassypages.com/">https://www.embassypages.com/</a>
	V-d	Share of other IsDB MCs that have signed FTAs	DESTA ( <a href="https://www.designoftradeagreements.org/downloads/">https://www.designoftradeagreements.org/downloads/</a> )
	V-e	Share of other IsDB MCs that have signed business investment treaties	UNCTAD



# METHODOLOGY



The construction of the IsDB Integration Index followed the standards of similar exercises accumulated so far. This process can be summarized in the following five steps.

- I. Gathering the raw data for the 21 input indicators from the sources presented in Table 1 above.
- II. Calculating each specific input indicator according to the formula/equation as explained in Table 2 below.
- III. Normalizing each indicator by using the minimum-maximum method.
- IV. Applying applicable interpolation techniques (backward, forward and linear interpolation).
- V. Applying the PCA model in two steps.

## CALCULATIONS AND FORMULAS

TABLE 2 METHOD OF CALCULATION FOR INPUT INDICATORS

DIMENSION	INDICATOR CODE	INDICATOR NAME	CALCULATION / METHOD
I. TRADE AND INVESTMENT INTEGRATION	I-a	Ratio of intra-IsDB exports to total exports	Exports of country $x_{it}$ to IsDB MCs divided by total exports of country $x_{it}$ ( $x_i$ = country, $x_t$ =year)
	I-b	Ratio of intra-IsDB imports to total imports	Imports of country $x_{it}$ to IsDB MCs divided by total imports of country $x_{it}$
	I-c	Ratio of intra-IsDB international trade to total international trade	Total intra-IsDB trade divided by total trade
	I-d	Ratio of intra-IsDB FDI inflows to total FDI inflows	Intra-IsDB FDI inflows divided by total FDI inflows to the country
II. FINANCIAL MARKETS INTEGRATION	II-a	Ratio of intra-IsDB cross-border equity liabilities to total cross-border equity liabilities	Intra-IsDB cross-border equity liabilities divided by total cross-border equity liabilities
	II-b	Ratio of intra-IsDB cross-border bond liabilities to total cross-border bond liabilities	Intra-IsDB cross-border bond liabilities divided by total cross-border bond liabilities
	II-c	Financial institutions depth index	The index national value
	II-d	Financial markets depth index	The index national value

# METHODOLOGY (CONTINUED)

**TABLE 2 METHOD OF CALCULATION FOR INPUT INDICATORS (CONTINUED)**

DIMENSION	INDICATOR CODE	INDICATOR NAME	CALCULATION / METHOD
III. PRODUCTION NETWORKS	III-a	Average trade complementarity index over IsDB trading partners	The mean value of the index over the IsDB MCs
	III-b	Average trade concentration index over IsDB trading partners	The mean value of the index over the IsDB MCs
	III-c	Ratio of intra-IsDB intermediate goods exports to total intra-IsDB goods exports	Intermediate goods are defined as the sum of the following categories in the Broad Economic Categories (BEC) coding.  111* Food and beverages, primary, mainly for industry  121* Food and beverages, processed, mainly for industry  21* Industrial supplies not elsewhere specified, primary  22* Industrial supplies not elsewhere specified, processed  31* Fuels and lubricants, primary  322* Fuels and lubricants, processed (other than motor spirit)  42* Parts and accessories of capital goods (except transport equipment)  53* Parts and accessories of transport equipment  Country $x_{it}$ intermediate exports to other IsDB MCs divided by Country $x_{it}$ total exports to IsDB MCs total exports
	III-d	Ratio of intra-IsDB intermediate goods imports to total intra-IsDB goods imports	Country $x_{it}$ intermediate imports to other IsDB MCs divided by Country $x_{it}$ total imports to IsDB MCs total imports
IV. CONNECTIVITY AND LOGISTICS	IV-a	Average trade cost over IsDB trading partners	The average of Country $x_{it}$ 's trade costs against each individual IsDB MC (one by one)
	IV-b	Average liner shipping connectivity index over IsDB trading partners	The average of Country $x_{it}$ 's index values against each individual IsDB MC (one by one)
	IV-c	Logistics performance index (overall)	Only the value for Country $x_{it}$
	IV-d	Fixed broadband subscriptions (per 100 people)	Only the value for Country $x_{it}$
V. HUMAN MOBILITY AND INSTITUTIONAL INTEGRATION	V-a	Share of other IsDB MCs that do not require an entry visa	Total number of IsDB MCs not requiring an entry visa divided by 56.
	V-b	Ratio of intra-IsDB migrant stock to total migrant stock	Total migrant stock in country $x_{it}$ from all IsDB MCs divided by total migrant stock in country $x_{it}$ from all over the world.
	V-c	Share of other IsDB MCs that have an embassy	Total number of IsDB MCs having an embassy/consulate in country $x_{it}$ divided by 56.
	V-d	Share of other IsDB MCs that have signed FTAs	Total number of IsDB MCs with signed FTAs divided by 56.
	V-e	Share of other IsDB MCs that have signed business investment treaties	Total number of IsDB MCs with signed bilateral business investment treaties divided by 56



## IMPUTATION OF MISSING DATA

There are several interpolation techniques for imputing missing data. For the IsDB Integration Index, three methods have been used, namely, linear regression (interpolation), forward interpolation and backward interpolation.

### LINEAR REGRESSION (INTERPOLATION):

The function applied for linear interpolation is the STATA statistical package “ipolate” and its attributes. The function generates a new indicator which is a linear interpolation of the original indicator based on the existing values. When the original value of the indicator is not missing or repeated, the new indicator simply takes the original value. The formula used is as follows:<sup>6</sup>

$$y = \frac{y_1 - y_0}{x_1 - x_0} (x - x_0) + y_0 \quad (1)$$

where  $(x_0, y_0)$  and  $(x_1, y_1)$  are the closest points for missing  $y$  at  $x$ .

If the missing value is at the end of the time series, then forward interpolation is applied to fill in the gaps in the data. When the missing value is at the beginning of the time series, then backward interpolation techniques are applied to bridge the gap.

## NORMALIZATION OF THE RAW DATA OF INDICATORS

The raw data for the selected indicators represents different scales, such as ratios, percentages, averages and others. All indicators convey quantitatively different information in different measurement units. Thus, the normalization of the data before applying the PCA is required to account for scaling issues and to avoid mixing apples and oranges. The resulting normalized indicators ranged between 0 and 1, with higher values denoting greater regional economic integration and lower values denoting less integration.

Time series data helped in employing the panel normalization and interpolation of the raw indicators over time. It also helped maintain the consistency of the indicator values over time. The employed normalization formula takes into consideration the country and the time. Below is the formula used.

$$\hat{x}_{it} = \frac{x_{it} - \min(x_{it})}{\max(x_{it}) - \min(x_{it})} \quad (2)$$

where  $x_{it}$  is indicator  $x$  for country  $i$  in year  $t$  and  $\hat{x}_{it}$  is the normalized indicator for country  $i$  in year  $t$ .

For the indicators where higher values of the original variable imply lower integration, such as average trade concentration ratio and average trade cost ratio, the transformation is given as follows:

$$\hat{x}_{it} = 1 - \frac{x_{it} - \min(x_{it})}{\max(x_{it}) - \min(x_{it})} \quad (3)$$

## WEIGHTING AND AGGREGATION

PCA is employed in two stages to arrive at the final scores for economic integration at the country level for a specific year. The first phase involves obtaining the five-dimensional level scores. The second stage involves applying PCA once more to obtain the final and aggregated intra-IsDB integration scores (values). Finally, simple averaging is conducted to have the aggregated IsDB level measurement of economic integration.

<sup>6</sup> Meijering, E. 2002. A chronology of interpolation: From ancient astronomy to modern signal and image processing. Proceedings of the IEEE 90: 319–342.



# EMPIRICAL RESULTS

This section discusses the application of PCA to the selected indicators under each dimension and then the estimated composite index for each dimension. Finally, the overall IsDB Integration Index weights and results are also presented.

## PCA DERIVED WEIGHTS

In applying PCA, the literature suggests keeping the components that have eigenvalues greater than one. For Dimension I, PCA results reveal that two components absorb more than 80 percent of the total variation of the indicators included (see table 5A at the appendix) for all years of the study (2010-2020). The first PCA represents trade, and the second represents investment. For Dimension II, two components have eigenvalues greater than one and absorb more than 70 percent of the total variation of the dimension for 2010–2020. For Dimension III, two components have eigenvalues greater than one and absorb more than 70 percent of the total variation by the indicators. For Dimension IV, one component has

an eigenvalue greater than one and account for more than 60 percent of the total variation of the indicators. Dimension 5 is represented by two components that account for more than 65 percent of the total variation.

## OVERALL IsDB INTEGRATION INDEX RESULTS

Table 3 below shows the weights, eigenvalues, the proportion of variation explained for each component, and the total cumulative proportion of variation explained by year. As shown, there are two principal components that have eigenvalues greater than one. The only one retained is the first component that represents each member country's score by applying the attached weights (Z1 row). Different weights are assigned to each dimension and even vary by year. The resulting final IsDB score for economic integration is the simple average score of the 57 MCs for each specific year. Table 4 shows the final estimated IsDB level scores for economic integration.

**TABLE 3 PCA RESULTS FOR THE OVERALL IsDB INTEGRATION INDEX**

	OVERALL IsDB INTEGRATION INDEX				
<b>2010</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.413	1.435	0.731	0.266	0.155
PROP.	0.483	0.287	0.146	0.053	0.031
CUMULATIVE PROP.	0.483	0.770	0.916	0.969	1.000
	SQUARED LOADINGS				
Z1	0.237	0.453	0.484	0.568	0.427
<b>2011</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.366	1.475	0.731	0.309	0.119
PROP.	0.473	0.295	0.146	0.062	0.024
CUMULATIVE PROP.	0.473	0.768	0.915	0.976	1.000
	SQUARED LOADINGS				
Z1	0.243	0.474	0.490	0.560	0.403
<b>2012</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.474	1.361	0.657	0.395	0.112
PROP.	0.495	0.272	0.131	0.079	0.023
CUMULATIVE PROP.	0.495	0.767	0.899	0.978	1.000
	SQUARED LOADINGS				
Z1	0.088	0.466	0.485	0.563	0.473



**TABLE 3 PCA RESULTS FOR THE OVERALL ISDB INTEGRATION INDEX (CONTINUED)**

	OVERALL ISDB INTEGRATION INDEX				
<b>2013</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.492	1.480	0.648	0.281	0.099
PROP.	0.498	0.296	0.130	0.056	0.020
CUMULATIVE PROP.	0.498	0.794	0.924	0.980	1.000
	<b>SQUARED LOADINGS</b>				
Z1	0.271	0.491	0.495	0.530	0.400
<b>2014</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.459	1.377	0.710	0.307	0.146
PROP.	0.492	0.276	0.142	0.061	0.029
CUMULATIVE PROP.	0.492	0.767	0.909	0.971	1.000
	<b>SQUARED LOADINGS</b>				
Z1	0.215	0.478	0.482	0.549	0.438
<b>2015</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.551	1.319	0.689	0.313	0.129
PROP.	0.510	0.264	0.138	0.063	0.026
CUMULATIVE PROP.	0.510	0.774	0.912	0.974	1.000
	<b>SQUARED LOADINGS</b>				
Z1	0.289	0.465	0.495	0.528	0.420
<b>2016</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.440	1.355	0.642	0.321	0.241
PROP.	0.488	0.271	0.128	0.064	0.048
CUMULATIVE PROP.	0.488	0.759	0.887	0.952	1.000
	<b>SQUARED LOADINGS</b>				
Z1	0.178	0.476	0.462	0.553	0.471
<b>2017</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.264	1.448	0.639	0.362	0.287
PROP.	0.453	0.290	0.128	0.073	0.057
CUMULATIVE PROP.	0.453	0.742	0.870	0.943	1.000
	<b>SQUARED LOADINGS</b>				
Z1	0.065	0.496	0.405	0.574	0.506
<b>2018</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.136	1.559	0.631	0.365	0.309
PROP.	0.427	0.312	0.126	0.073	0.062
CUMULATIVE PROP.	0.427	0.739	0.865	0.938	1.000
	<b>SQUARED LOADINGS</b>				
Z1	-0.100	0.527	0.234	0.598	0.548

# EMPIRICAL RESULTS (CONTINUED)

**TABLE 3 PCA RESULTS FOR THE OVERALL ISDB INTEGRATION INDEX (CONTINUED)**

	OVERALL ISDB INTEGRATION INDEX				
<b>2019</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.155	1.639	0.620	0.387	0.198
PROP.	0.431	0.328	0.124	0.077	0.040
CUMULATIVE PROP.	0.431	0.759	0.883	0.960	1.000
	SQUARED LOADINGS				
Z1	-0.421	0.452	-0.273	0.558	0.482
<hr/>					
<b>2020</b>	<b>COMP. 1</b>	<b>COMP. 2</b>	<b>COMP. 3</b>	<b>COMP. 4</b>	<b>COMP. 5</b>
EIGENVALUE	2.010	1.703	0.664	0.413	0.210
PROP.	0.402	0.341	0.133	0.083	0.042
CUMULATIVE PROP.	0.402	0.743	0.875	0.958	1.000
	SQUARED LOADINGS				
Z1	-0.432	0.402	-0.280	0.573	0.494

## PERFORMANCE OF ISDB MEMBER COUNTRIES

Table 4, Figure 1 and Figure 2 present the main findings regarding the level of integration of IsDB MCs by dimension and overall. The overall index scores show a deterioration in economic integration over time. Graph 1 shows that a downward trend in the trade and investment integration dimension from 2010 to 2020 has mainly led to a decline in

the overall index scores. In 2010, the strongest dimension of intra-IsDB integration was trade and investments followed by production networks. Since 2017, the largest driver of integration is the production networks dimension. The financial markets integration dimension has the lowest scores. Connectivity and logistics keep a moderate level of integration over time in general. A similar pattern is observed for human mobility and institutional integration. Figure 2 compares the levels of integration from 2010 to 2020.

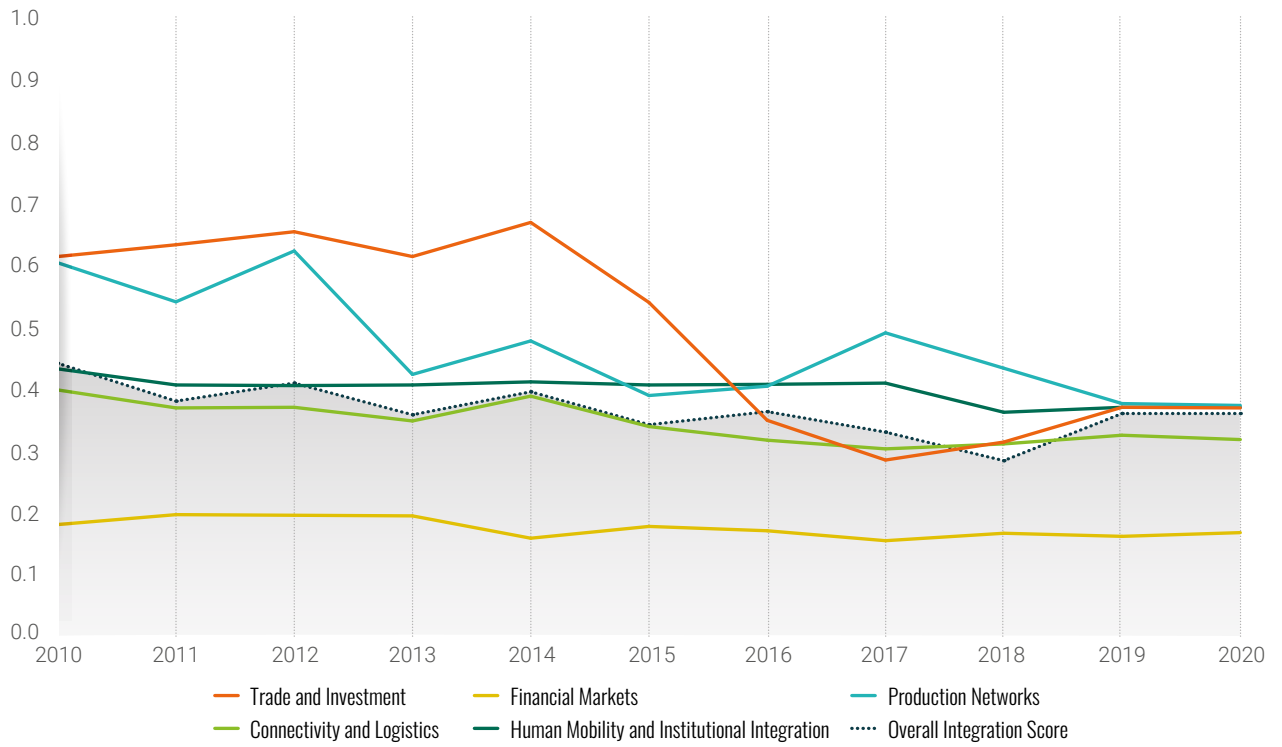
**TABLE 4 ISDB INTEGRATION INDEX SCORES BY DIMENSIONS AND YEARS (2010-2020)**

YEAR	DIM1	DIM2	DIM3	DIM4	DIM5	OVERALL
2010	0.612	0.180	0.602	0.397	0.431	0.440
2011	0.625	0.196	0.539	0.368	0.405	0.376
2012	0.652	0.195	0.621	0.369	0.404	0.408
2013	0.612	0.194	0.422	0.347	0.405	0.357
2014	0.667	0.158	0.476	0.387	0.410	0.394
2015	0.538	0.177	0.388	0.338	0.405	0.341
2016	0.348	0.170	0.403	0.316	0.406	0.362
2017	0.284	0.154	0.489	0.302	0.408	0.329
2018	0.313	0.166	0.432	0.310	0.361	0.283
2019	0.369	0.161	0.375	0.324	0.369	0.359
2020	0.368	0.167	0.372	0.317	0.369	0.359

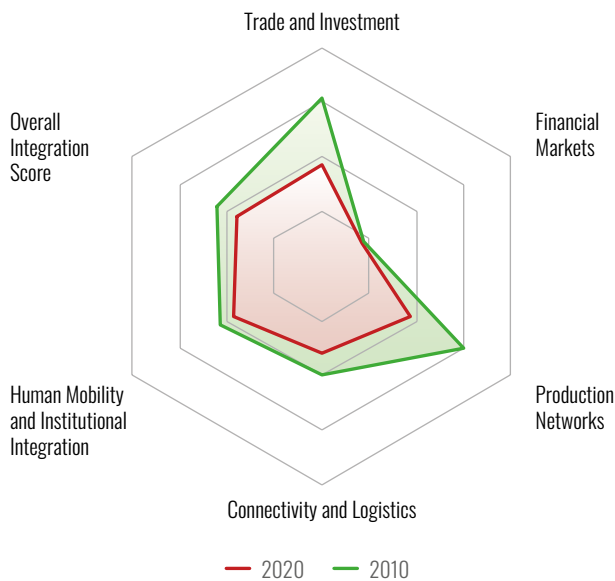




**FIGURE 1** IsDB INTEGRATION INDEX (2010-2020)



**FIGURE 2** IsDB INTEGRATION INDEX BY DIMENSIONS



The overall index scores show a deterioration in economic integration over time. A downward trend in the trade and investment integration dimension from 2010 to 2020 has mainly led to a decline in the overall index scores.

# EMPIRICAL RESULTS (CONTINUED)



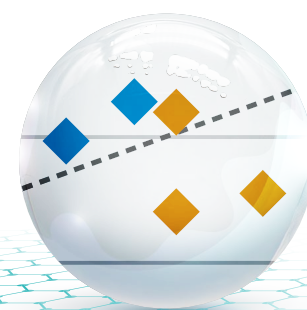
Table 5 shows the overall and dimensional scores for IsDB hubs and different groups of MCs. The grouping scores are calculated as simple average over the country scores. The results show that the Headquarters (COO) is the most integrated group of IsDB MCs with a score

of 0.633 and the Almaty (Kazakhstan) Hub is the least integrated (0.155). The Middle East and North Africa (MENA) geographic region is the most integrated (0.48) and the Sub-Saharan Africa is the least integrated (0.265).

**TABLE 5** IsDB INTEGRATION INDEX SCORES BY GROUPS AND DIMENSIONS (2020)

REGIONAL HUB	DIM1	DIM2	DIM3	DIM4	DIM5	OVERALL SCORE
HEADQUARTERS (COO)	0.436	0.425	0.513	0.442	0.560	0.633
CAIRO (EGYPT) HUB	0.446	0.214	0.503	0.315	0.472	0.318
RABAT (MOROCCO) HUB	0.202	0.113	0.222	0.267	0.605	0.490
ANKARA (TÜRKİYE) HUB	0.371	0.166	0.379	0.424	0.436	0.402
ABUJA (NIGERIA) HUB	0.274	0.057	0.333	0.291	0.298	0.253
DAKAR (SENEGAL) HUB	0.560	0.062	0.430	0.258	0.321	0.284
KAMPALA (UGANDA) HUB	0.521	0.048	0.232	0.218	0.125	0.256
PARAMARIBO (SURINAME) HUB	0.267	0.101	0.206	0.066	0.002	0.166
ALMATY (KAZAKHSTAN) HUB	0.298	0.068	0.271	.	0.249	0.155
JAKARTA (INDONESIA) HUB	0.160	0.207	0.308	0.212	0.332	0.451
DHAKA (BANGLADESH) HUB	0.222	0.172	0.408	0.169	0.085	0.300
<b>MACRO REGIONAL GROUPINGS</b>						
SUB SAHARAN AFRICA (SSA)	0.436	0.057	0.352	0.264	0.270	0.265
ASIA, LATIN AMERICA & EUROPE (ALAE)	0.281	0.184	0.326	0.301	0.294	0.331
MIDDLE EAST AND NORTH AFRICA (MENA)	0.378	0.271	0.437	0.359	0.540	0.480
<b>OIL EXPORTERS</b>						
ISDB FUEL EXPORTERS	0.305	0.227	0.396	0.353	0.451	0.406
ISDB NON-FUEL EXPORTERS	0.397	0.138	0.363	0.298	0.331	0.337
<b>LDMC STATUS</b>						
LDMC	0.491	0.072	0.392	0.193	0.263	0.255
NON-LDMC	0.272	0.234	0.357	0.381	0.449	0.434
TOTAL ISDB	0.368	0.167	0.372	0.317	0.369	0.359

# ROBUSTNESS OF THE RESULTS



Some empirical tests were conducted to check the robustness of the index results. These tests are the correlation coefficient test, the Cronbach's alpha reliability coefficient test, and finally Kaiser-Meyer-Olkin (KMO) test.

The Stata routine for Cronbach's alpha reliability coefficient function is used to assess the reliability of the integration index as summative rating scale composed

of the set of variables specified. The alpha scale is simply the sum of the variables scores, reversing the scoring for statements that have negative correlations with the resulted factor that is being measured (Cronbach, 1951 and Stata manual). The reliability alpha test is defined as the square of the correlation between the measured scale and the underlying factor.

**TABLE 6 THE RELIABILITY ALPHA TEST FOR DIMENSION I: TRADE AND INVESTMENT INTEGRATION, 2010**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
D11_2010	57	+	0.709	0.455	0.354	0.622
D12_2010	57	+	0.775	0.558	0.291	0.552
D13_2010	57	+	0.926	0.836	0.148	0.342
D14_2010	57	-	0.450	0.112	0.601	0.819
TEST SCALE					0.348	0.681

**TABLE 7 THE RELIABILITY ALPHA TEST FOR DIMENSION I: TRADE AND INVESTMENT INTEGRATION, 2020**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
D11_2020	57	+	0.750	0.510	0.264	0.518
D12_2020	57	+	0.736	0.486	0.277	0.535
D13_2020	57	+	0.919	0.818	0.107	0.264
D14_2020	57	+	0.381	0.024	0.607	0.822
TEST SCALE					0.314	0.646

Tables 6 and 7 show that the derived scale from our items (variables/indicators) appears to be reasonable, because the estimated correlation between them and the underlying factor it measures is  $\sqrt{0.681} = 0.464$  in 2010 and the estimated correlation between this test of 4 items and all other item batteries from the same domain is 0.348. For 2020, the square root of alpha equals 0.417 and the estimated correlation between this test of 4 items and all other item batteries from the same domain is 0.314. The same test was done for the rest of the dimensions and for the overall IsDB integration index, and similar results and conclusions were derived (see appendix).

When all sources of uncertainties are considered carefully, the analysis of these uncertainties included in the development of the composite index can make its building process more robust. This is because no model

(composite index construction) is better than another, provided that internal coherence is always checked, as each model serves different interests. The composite index is no longer a unique number corresponding to hard data treatment, weighting set or aggregation method, but reflects uncertainty and ambiguity in a more transparent and defensible fashion.

## KAISER-MEYER-OLKIN (KMO) TEST:

The KMO test is considered to ensure the sampling adequacy of the regional integration index where partial correlation is used to measure the relationship between two variables excluding the effects of other variables. A high KMO (usually > 0.5) indicates that PCA is relevant, which is the case in the IsDB overall Integration Index (0.525 and 0.542 for years 2010 and 2020 respectively).



# METHODOLOGICAL SUMMARY



This report provides information on the process of constructing a composite index to measure the level of intra-IsDB integration.

PCA was used as the statistical technique to aggregate and weigh data into a single index.

Several missing data interpolation techniques were also used, namely, forward, backward and linear interpolation. The maximum-minimum normalization technique was employed in scaling the data before and after applying the PCA.

For comparability reasons, time series data which is available for the entire period of the study (2010–2020) were selected and used.

The robustness analysis confirms the relevance of selected indicators in their dimensions of integration. The alpha reliability test shows reasonable results as it is 0.6 or above for all dimension and the overall integration index.



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# STATISTICAL APPENDIX

**TABLE A1 THE RELIABILITY ALPHA TEST FOR DIMENSION II: FINANCIAL MARKETS INTEGRATION**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
			2010				2020			
D21	56	+	0.5447	0.122	0.3007	0.5633	0.6124	0.2673	0.2548	0.5063
D22	57	+	0.487	0.0869	0.3294	0.5957	0.5731	0.2167	0.2875	0.5476
D23	53	+	0.7055	0.4044	0.1379	0.3243	0.6808	0.375	0.1827	0.4014
D24	53	+	0.8209	0.6006	0.0418	0.1158	0.7162	0.4293	0.1536	0.3526
TEST SCALE					0.2013	0.5021			0.219	0.5287

**TABLE A2 THE RELIABILITY ALPHA TEST FOR DIMENSION III: PRODUCTION NETWORKS**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
			2010				2020			
D31	50	+	0.7503	0.4736	0.2846	0.5441	0.3841	-0.0722	0.2153	0.4516
D32	50	+	0.7022	0.3983	0.3389	0.606	0.6747	0.2434	0.0294	0.0834
D33	57	+	0.7574	0.4768	0.3186	0.5838	0.6757	0.2056	0.0551	0.149
D34	56	+	0.7015	0.4378	0.32	0.5853	0.5877	0.1455	0.0708	0.1861
TEST SCALE					0.3155	0.6483			0.0934	0.2919





**TABLE A3 THE RELIABILITY ALPHA TEST FOR DIMENSION IV: CONNECTIVITY AND LOGISTICS**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
			2010				2020			
D41	51	+	0.731	0.405	0.408	0.674	0.717	0.451	0.441	0.703
D42	42	+	0.781	0.575	0.312	0.576	0.831	0.661	0.318	0.584
D43	55	+	0.820	0.625	0.287	0.547	0.684	0.373	0.475	0.730
D44	56	+	0.670	0.405	0.468	0.725	0.785	0.497	0.388	0.656
TEST SCALE					0.366	0.698			0.403	0.729

**TABLE A4 THE RELIABILITY ALPHA TEST FOR DIMENSION V: HUMAN MOBILITY AND INSTITUTIONAL INTEGRATION**

ITEM	OBS	SIGN	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA	ITEM-TEST CORRELATION	ITEM-REST CORRELATION	AVERAGE INTERITEM CORRELATION	ALPHA
			2010				2020			
D51	57	+	0.557	0.280	0.296	0.627	0.538	0.247	0.269	0.595
D52	56	+	0.475	0.177	0.338	0.671	0.477	0.172	0.299	0.630
D53	57	+	0.715	0.497	0.211	0.517	0.755	0.550	0.157	0.426
D54	57	+	0.725	0.512	0.205	0.507	0.556	0.268	0.259	0.582
D55	57	+	0.705	0.483	0.216	0.524	0.763	0.562	0.152	0.418
TEST SCALE					0.2534	0.6292			0.227	0.5949

# STATISTICAL APPENDIX (CONTINUED)

**TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020**

	DIM 1				DIM 2				DIM 3			
	1	2	3	4	1	2	3	4	1	2	3	4
<b>2010</b>												
EIGENVALUE	2.382	1.853	0.717	0.049	1.801	1.081	0.896	0.221	1.936	0.935	0.667	0.462
PROP.	0.476	0.371	0.143	0.01	0.45	0.27	0.224	0.055	0.484	0.234	0.167	0.116
CUMULATIVE PROP.	0.476	0.847	0.99	1	0.45	0.721	0.945	1	0.484	0.718	0.885	1
<b>SQUARED LOADINGS</b>												
Z1	0.405	0.481	0.559	-0.382	0.214	0.148	-0.666	-0.699	-0.576	-0.506	0.455	0.454
Z2	0.333	0.254	0.349	0.593	0.6	0.74	0.3	0.055	0.322	0.582	0.537	0.519
<b>2011</b>												
EIGENVALUE	2.548	1.776	0.619	0.057	1.936	1.074	0.765	0.225	1.855	1.165	0.44	0.44
PROP.	0.51	0.355	0.124	0.011	0.484	0.268	0.191	0.056	0.464	0.291	0.135	0.11
CUMULATIVE PROP.	0.51	0.865	0.989	1	0.484	0.753	0.944	1	0.464	0.755	0.89	1
<b>SQUARED LOADINGS</b>												
Z1	0.428	0.474	0.542	-0.386	0.369	0.303	-0.582	-0.658	0.547	0.4	-0.538	-0.502
Z2	0.341	0.253	0.35	0.59	0.511	0.691	0.477	0.182	0.389	0.655	0.433	0.483
<b>2012</b>												
EIGENVALUE	2.422	1.767	0.743	0.067	1.911	1.1	0.745	0.243	1.643	1.148	0.787	0.421
PROP.	0.484	0.354	0.149	0.013	0.478	0.275	0.186	0.061	0.411	0.287	0.197	0.105
CUMULATIVE PROP.	0.484	0.838	0.987	1	0.478	0.753	0.939	1	0.411	0.698	0.895	1
<b>SQUARED LOADINGS</b>												
Z1	0.409	0.437	0.533	-0.423	0.353	0.349	-0.566	-0.658	-0.6	-0.597	0.424	0.322
Z2	0.344	0.294	0.394	0.566	0.568	0.617	0.509	0.195	0.401	0.332	0.52	0.678
<b>2013</b>												
EIGENVALUE	2.43	1.842	0.675	0.053	1.861	1.293	0.597	0.249	1.651	1.255	0.591	0.503
PROP.	0.486	0.369	0.135	0.011	0.465	0.323	0.149	0.062	0.413	0.314	0.148	0.126
CUMULATIVE PROP.	0.486	0.855	0.99	1	0.465	0.789	0.938	1	0.413	0.726	0.874	1
<b>SQUARED LOADINGS</b>												
Z1	0.419	0.486	0.56	-0.371	0.405	0.27	-0.573	-0.66	0.532	0.383	-0.573	-0.492
Z2	0.314	0.261	0.334	0.601	0.535	0.678	0.459	0.207	0.438	0.629	0.387	0.513



**TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)**

	DIM 1				DIM 2				DIM 3			
	1	2	3	4	1	2	3	4	1	2	3	4
<b>2014</b>												
EIGENVALUE	2.345	1.865	0.738	0.053	1.738	1.087	0.895	0.279	1.679	1.063	0.699	0.56
PROP.	0.469	0.373	0.148	0.011	0.435	0.272	0.224	0.07	0.42	0.266	0.175	0.14
CUMULATIVE PROP.	0.469	0.842	0.99	1	0.435	0.706	0.93	1	0.42	0.685	0.86	1
<b>SQUARED LOADINGS</b>												
Z1	0.358	0.498	0.545	-0.404	0.024	0.273	-0.657	-0.702	-0.554	-0.488	0.519	0.431
Z2	0.378	0.239	0.381	0.572	0.743	0.612	0.272	0.009	0.403	0.535	0.432	0.603
<b>2015</b>												
EIGENVALUE	2.499	1.799	0.659	0.042	1.802	1.088	0.85	0.26	1.626	1.388	0.647	0.34
PROP.	0.5	0.36	0.132	0.009	0.45	0.272	0.213	0.065	0.407	0.347	0.162	0.085
CUMULATIVE PROP.	0.5	0.86	0.992	1	0.45	0.722	0.935	1	0.407	0.754	0.915	1
<b>SQUARED LOADINGS</b>												
Z1	0.409	0.487	0.549	-0.384	0.143	0.31	-0.641	-0.687	-0.563	-0.464	0.591	0.343
Z2	0.327	0.265	0.349	0.592	0.741	0.579	0.318	0.119	0.307	0.569	0.344	0.682
<b>2016</b>												
EIGENVALUE	2.333	2.017	0.606	0.044	1.735	1.206	0.785	0.274	1.757	1.119	0.628	0.497
PROP.	0.467	0.404	0.121	0.009	0.434	0.301	0.196	0.069	0.439	0.28	0.157	0.124
CUMULATIVE PROP.	0.467	0.87	0.991	1	0.434	0.735	0.931	1	0.439	0.719	0.876	1
<b>SQUARED LOADINGS</b>												
Z1	0.528	-0.538	-0.638	0.112	0.105	0.221	-0.668	-0.702	-0.545	-0.491	0.542	0.41
Z2	0.018	0.174	0.111	0.692	0.697	0.666	0.257	0.07	0.367	0.546	0.366	0.658
<b>2017</b>												
EIGENVALUE	2.599	1.753	0.588	0.059	1.745	1.096	0.895	0.265	1.794	1.075	0.69	0.44
PROP.	0.52	0.351	0.118	0.012	0.436	0.274	0.224	0.066	0.449	0.269	0.173	0.11
CUMULATIVE PROP.	0.52	0.871	0.988	1	0.436	0.71	0.934	1	0.449	0.717	0.89	1
<b>SQUARED LOADINGS</b>												
Z1	0.491	0.339	0.501	-0.444	0.111	0.11	-0.693	-0.704	0.43	0.491	-0.57	-0.5
Z2	0.143	0.517	0.424	0.516	0.692	0.7	0.17	0.051	0.572	0.489	0.381	0.537



# STATISTICAL APPENDIX (CONTINUED)

TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)

	DIM 1				DIM 2				DIM 3			
	1	2	3	4	1	2	3	4	1	2	3	4
<b>2018</b>												
EIGENVALUE	2.371	1.924	0.642	0.063	1.797	0.986	0.95	0.267	1.477	1.092	0.903	0.527
PROP.	0.474	0.385	0.128	0.013	0.449	0.247	0.237	0.067	0.369	0.273	0.226	0.132
CUMULATIVE PROP.	0.474	0.859	0.988	1	0.449	0.696	0.933	1	0.369	0.642	0.868	1
<b>SQUARED LOADINGS</b>												
Z1	-0.49	-0.417	-0.544	0.381	0.201	0.225	-0.662	-0.686	0.341	0.618	-0.605	-0.368
Z2	0.128	0.424	0.369	0.578	0.709	0.629	0.289	0.134	0.667	0.329	0.375	0.554
<b>2019</b>												
EIGENVALUE	2.157	2.028	0.744	0.072	1.737	1.269	0.708	0.286	1.408	1.021	0.873	0.698
PROP.	0.431	0.406	0.149	0.014	0.434	0.317	0.177	0.072	0.352	0.255	0.218	0.175
CUMULATIVE PROP.	0.431	0.837	0.986	1	0.434	0.752	0.928	1	0.352	0.607	0.825	1
<b>SQUARED LOADINGS</b>												
Z1	0.504	-0.52	-0.649	0.165	0.203	0.075	-0.687	-0.694	0.019	0.624	-0.611	-0.486
Z2	0.005	0.238	0.159	0.678	0.667	0.717	0.172	0.102	0.965	0.194	0.151	0.096
<b>2020</b>												
EIGENVALUE	2.247	2.005	0.69	0.058	1.741	1.348	0.625	0.286	1.417	1.02	0.871	0.693
PROP.	0.45	0.401	0.138	0.012	0.435	0.337	0.156	0.156	0.354	0.255	0.218	0.173
CUMULATIVE PROP.	0.45	0.85	0.988	1	0.435	0.772	0.928	1.085	0.354	0.609	0.827	1
<b>SQUARED LOADINGS</b>												
Z1	0.513	-0.528	-0.645	0.145	0.223	0.163	-0.674	-0.685	0.055	0.637	-0.587	0.496
Z2	0.036	0.19	0.124	0.688	0.665	0.694	0.222	0.164	0.96	0.106	0.254	0.056



**TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)**

	DIM 4				DIM 5					OVERALL				
	1	2	3	4	1	2	3	4	5	1	2	3	4	5
<b>2010</b>														
EIGENVALUE	2.411	0.950	0.451	0.451	2.086	1.213	0.887	0.495	0.320	2.413	1.435	0.731	0.266	0.155
PROP.	0.603	0.238	0.113	0.047	0.417	0.243	0.177	0.099	0.064	0.483	0.287	0.146	0.053	0.031
CUMULATIVE PROP.	0.603	0.840	0.953	1.000	0.417	0.660	0.837	0.936	1.000	0.483	0.770	0.916	0.969	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.477	0.479	-0.544	-0.497	0.320	0.208	-0.558	0.487	-0.553	0.237	0.453	0.484	0.568	0.427
Z2	0.498	0.532	0.395	0.559	0.066	0.775	0.300	0.401	0.380					
<b>2011</b>														
EIGENVALUE	2.397	0.958	0.450	0.195	2.055	1.222	0.922	0.509	0.293	2.366	1.475	0.731	0.309	0.119
PROP.	0.599	0.240	0.113	0.049	0.411	0.244	0.184	0.102	0.059	0.473	0.295	0.146	0.062	0.024
CUMULATIVE PROP.	0.599	0.839	0.951	1.000	0.411	0.655	0.840	0.941	1.000	0.473	0.768	0.915	0.976	1.000
<b>SQUARED LOADINGS</b>														
Z1	-0.508	-0.497	0.543	0.447	-0.277	-0.277	-0.579	0.469	-0.576	0.243	0.474	0.490	0.560	0.403
Z2	0.405	0.539	0.327	0.662	0.209	0.772	0.184	0.457	0.344					
<b>2012</b>														
EIGENVALUE	2.421	0.871	0.444	0.263	2.069	1.207	0.924	0.522	0.279	2.474	1.361	0.657	0.395	0.112
PROP.	0.605	0.218	0.111	0.066	0.414	0.241	0.185	0.104	0.056	0.495	0.272	0.131	0.079	0.023
CUMULATIVE PROP.	0.605	0.823	0.934	1.000	0.414	0.655	0.840	0.944	1.000	0.495	0.767	0.899	0.978	1.000
<b>SQUARED LOADINGS</b>														
Z1	-0.512	-0.517	0.535	0.429	-0.289	0.211	-0.578	0.466	-0.566	0.088	0.466	0.485	0.563	0.473
Z2	0.409	0.487	0.288	0.716	0.105	0.773	0.214	0.446	0.383					

# STATISTICAL APPENDIX (CONTINUED)

**TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)**

	DIM 4				DIM 5					OVERALL				
	1	2	3	4	1	2	3	4	5	1	2	3	4	5
<b>2013</b>														
EIGENVALUE	2.379	0.828	0.529	0.264	2.107	1.182	0.901	0.533	0.277	2.492	1.480	0.648	0.281	0.099
PROP.	0.595	0.207	0.132	0.066	0.421	0.236	0.180	0.107	0.055	0.498	0.296	0.130	0.056	0.020
CUMULATIVE PROP.	0.595	0.802	0.934	1.000	0.421	0.658	0.838	0.945	1.000	0.498	0.794	0.924	0.980	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.474	0.495	-0.549	-0.480	-0.314	0.232	-0.571	0.455	-0.561	0.271	0.491	0.495	0.530	0.400
Z2	0.491	0.504	0.327	0.631	0.140	0.764	0.213	0.449	0.386					
<b>2014</b>														
EIGENVALUE	2.309	0.789	0.569	0.333	2.109	1.175	0.902	0.543	0.271	2.459	1.377	0.710	0.307	0.146
PROP.	0.577	0.197	0.142	0.083	0.422	0.235	0.180	0.109	0.054	0.492	0.276	0.142	0.061	0.029
CUMULATIVE PROP.	0.577	0.775	0.917	1.000	0.422	0.657	0.837	0.946	1.000	0.492	0.767	0.909	0.971	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.495	0.480	-0.536	-0.487	-0.304	0.238	-0.574	0.452	-0.563	0.215	0.478	0.482	0.549	0.438
Z2	0.367	0.606	0.303	0.637	0.235	0.750	0.174	0.456	0.380					
<b>2015</b>														
EIGENVALUE	2.389	0.808	0.516	0.287	2.134	1.216	0.818	0.560	0.272	2.551	1.319	0.689	0.313	0.129
PROP.	0.597	0.202	0.129	0.072	0.427	0.243	0.164	0.112	0.054	0.510	0.264	0.138	0.063	0.026
CUMULATIVE PROP.	0.597	0.799	0.928	1.000	0.427	0.670	0.834	0.946	1.000	0.510	0.774	0.912	0.974	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.493	0.499	-0.529	-0.478	-0.330	0.219	-0.580	0.421	-0.574	0.289	0.465	0.495	0.528	0.420
Z2	0.459	0.523	0.360	0.621	0.423	0.694	0.075	0.490	0.305					



**TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)**

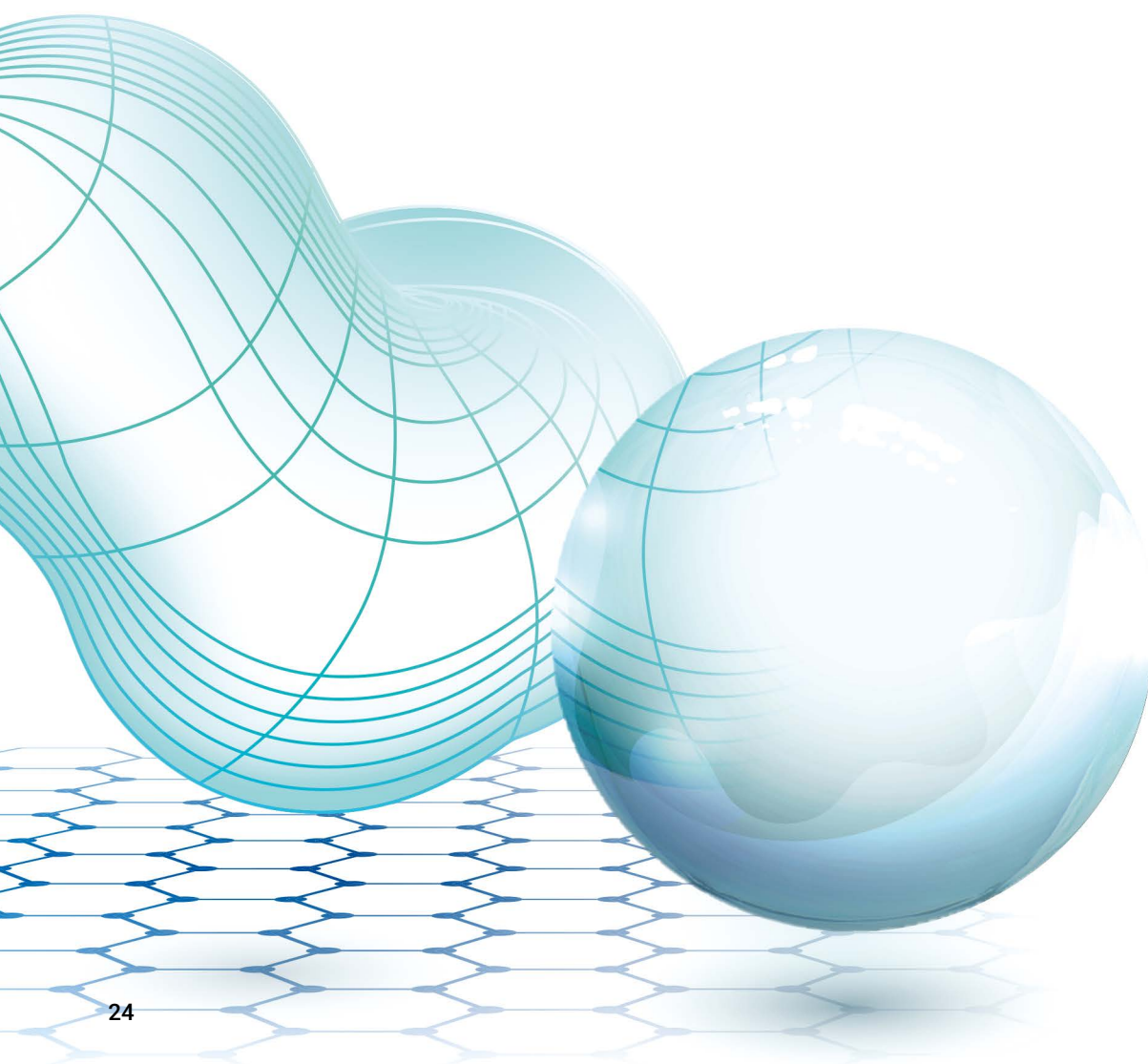
	DIM 4				DIM 5					OVERALL				
	1	2	3	4	1	2	3	4	5	1	2	3	4	5
<b>2016</b>														
EIGENVALUE	2.242	0.969	0.524	0.265	2.142	1.200	0.827	0.569	0.263	2.440	1.355	0.642	0.321	0.241
PROP.	0.560	0.242	0.131	0.066	0.428	0.240	0.166	0.114	0.053	0.488	0.271	0.128	0.064	0.048
CUMULATIVE PROP.	0.560	0.803	0.934	1.000	0.428	0.668	0.834	0.948	1.000	0.488	0.759	0.887	0.952	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.443	0.544	-0.535	-0.471	-0.327	0.225	-0.577	0.426	-0.572	0.178	0.476	0.462	0.553	0.471
Z2	0.637	0.359	0.414	0.542	0.400	0.708	0.089	0.479	0.317					
<b>2017</b>														
EIGENVALUE	2.367	0.948	0.444	0.241	2.112	1.256	0.808	0.567	0.257	2.264	1.448	0.639	0.362	0.287
PROP.	0.592	0.237	0.111	0.060	0.423	0.251	0.162	0.114	0.051	0.453	0.290	0.128	0.073	0.057
CUMULATIVE PROP.	0.592	0.829	0.940	1.000	0.423	0.674	0.835	0.949	1.000	0.453	0.742	0.870	0.943	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.432	0.544	-0.523	-0.494	-0.307	0.218	-0.589	0.417	-0.581	0.065	0.496	0.405	0.574	0.506
Z2	0.680	0.327	0.452	0.475	0.472	0.669	0.055	0.489	0.297					
<b>2018</b>														
EIGENVALUE	2.251	1.001	0.407	0.342	2.020	1.323	0.762	0.641	0.254	2.136	1.559	0.631	0.365	0.309
PROP.	0.563	0.250	0.102	0.085	0.404	0.265	0.152	0.128	0.051	0.427	0.312	0.126	0.073	0.062
CUMULATIVE PROP.	0.563	0.813	0.915	1.000	0.404	0.669	0.821	0.949	1.000	0.427	0.739	0.865	0.938	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.401	0.559	-0.536	-0.489	-0.375	0.176	0.602	0.281	-0.622	-0.100	0.527	0.234	0.598	0.548
Z2	0.722	0.285	0.373	0.508	0.428	0.642	0.011	0.602	0.206					
<b>2019</b>														
EIGENVALUE	2.186	0.948	0.492	0.374	2.039	1.303	0.749	0.662	0.246	2.155	1.639	0.620	0.387	0.198
PROP.	0.546	0.237	0.123	0.094	0.408	0.261	0.150	0.133	0.049	0.431	0.328	0.124	0.077	0.040
CUMULATIVE PROP.	0.546	0.783	0.906	1.000	0.408	0.669	0.818	0.951	1.000	0.431	0.759	0.883	0.960	1.000
<b>SQUARED LOADINGS</b>														
Z1	0.428	0.570	-0.525	-0.466	-0.389	0.178	0.593	0.290	-0.618	-0.421	0.452	-0.273	0.558	0.482
Z2	0.715	0.224	0.304	0.588	0.403	0.666	0.007	0.588	0.221					



# STATISTICAL APPENDIX (CONTINUED)

TABLE A5 PRINCIPAL COMPONENT ANALYSIS RESULTS AND WEIGHTS FOR AGGREGATION, 2010 – 2020 (CONTINUED)

	DIM 4				DIM 5					OVERALL				
	1	2	3	4	1	2	3	4	5	1	2	3	4	5
<b>2020</b>														
EIGENVALUE	1.995	0.961	0.661	0.383	2.041	1.301	0.752	0.660	0.246	2.010	1.703	0.664	0.413	0.210
PROP.	0.499	0.240	0.165	0.096	0.408	0.260	0.150	0.132	0.049	0.402	0.341	0.133	0.083	0.042
CUMULATIVE PROP.	0.499	0.739	0.904	1.000	0.408	0.669	0.819	0.951	1.000	0.402	0.743	0.875	0.958	1.000
<b>SQUARED LOADINGS</b>														
Z1	-0.472	-0.591	0.485	0.440	-0.388	0.182	0.592	0.291	-0.617	-0.432	0.402	-0.280	0.573	0.494
Z2	0.669	0.197	0.299	0.652	0.401	0.664	0.003	0.590	0.224					





**TABLE A6 COMPARISON BETWEEN INTEGRATION INDEXES OF ASIA-PACIFIC, AFRICA AND ISDB**

	<b>ASIA-PACIFIC REGIONAL INTEGRATION INDEX (ARCII)</b>	<b>AFRICA REGIONAL INTEGRATION INDEX (ARII)</b>	<b>IsDB INTEGRATION INDEX (III)</b>
<b>DIMENSIONS</b>	Eight dimensions: 1. Trade & Investment Integration, 2. Money & Finance Integration, 3. Regional Value Chain, 4. Infrastructure & Connectivity, 5. Free Movement of People, 6. Institutional & Social Integration, 7. Technology and Digital Connectivity, 8. Environmental Cooperation.	Five dimensions: 1. Trade Integration, 2. Productive Integration, 3. Macroeconomic Integration, 4. Infrastructural Integration, 5. Free Movement of People.	Five dimensions: 1. Trade and Investment Integration, 2. Financial Markets Integration, 3. Production Networks, 4. Connectivity and Logistics, 5. Human Mobility and Institutional Integration.
<b>INDICATORS</b>	41 indicators <b>Note:</b> The ARCII indicator list is continuously enhanced to capture new drivers of regional integration.	16 indicators <b>Note:</b> Although the number of dimensions and indicators between <b>ARII 2016</b> and <b>ARII 2019</b> remains the same (5 and 16, respectively), some of the indicators used in 2016 were removed and others were added.	21 indicators
<b>COUNTRIES COVERED</b>	48 Asian economies (the study also covers comparative regional integration indices for other regions of the world)	55 member countries from the eight Regional Economic Communities (RECs) recognized by the African Union	55 IsDB MCs out of its 57 MCs (sufficient data is not available for two IsDB MCs)
<b>YEAR COVERED</b>	Latest available and consistent data	Latest available and consistent data <b>Note:</b> Due to data availability constraints, the countries and years covered in this report may differ for each indicator.	The data are annual starting from 2010 to the latest year (2020) for which data are available.
<b>METHODOLOGY:</b>			
<b>CONSTRUCTION OF INDEX</b>	Two steps: 1. Normalized indicators are weight-averaged in each dimension to produce a composite dimensional index, 2. The dimensional indexes are weight-averaged to yield an overall index of regional integration. <b>Note:</b> The weights used in this report are assigned using the principal component analysis (PCA).	Three steps: 1. Normalization of base indicators, 2. Calculation of composite indices by dimensions (dimensional indices) and the ARII index, 3. Calculation of composite indices per REC. <b>Note:</b> While the 2016 ARII assigned equal weight to the indicators and dimensions, the 2019 ARII assigned them different weights, namely using principal component analysis (PCA).	Three steps: 1. Normalization of base indicators, 2. Calculation of composite index scores by dimensions (dimensional indices) and the overall IsDB Integration index, 3. Calculation of composite index scores per regional groupings.







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