

Measuring value chains - Use of input-output tables

Ali Yedan, Ph.D., Associate Statistician,
Africa Centre for Statistics,
United Nations Economic Commission for Africa

“The Gambia’s tourism sector:
Measuring its value chain and exploiting its potential”

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Context

▶ **Objective:**

- Better assess the contribution of services to regional value chains
- Provide good indicators for Measuring value chains

▶ The quantitative approach

- ❖ based on the literature on trade in value added,
- ❖ uses multi-region input output tables (MRIOs),
- ❖ uses algebraic formula and computation in software like R

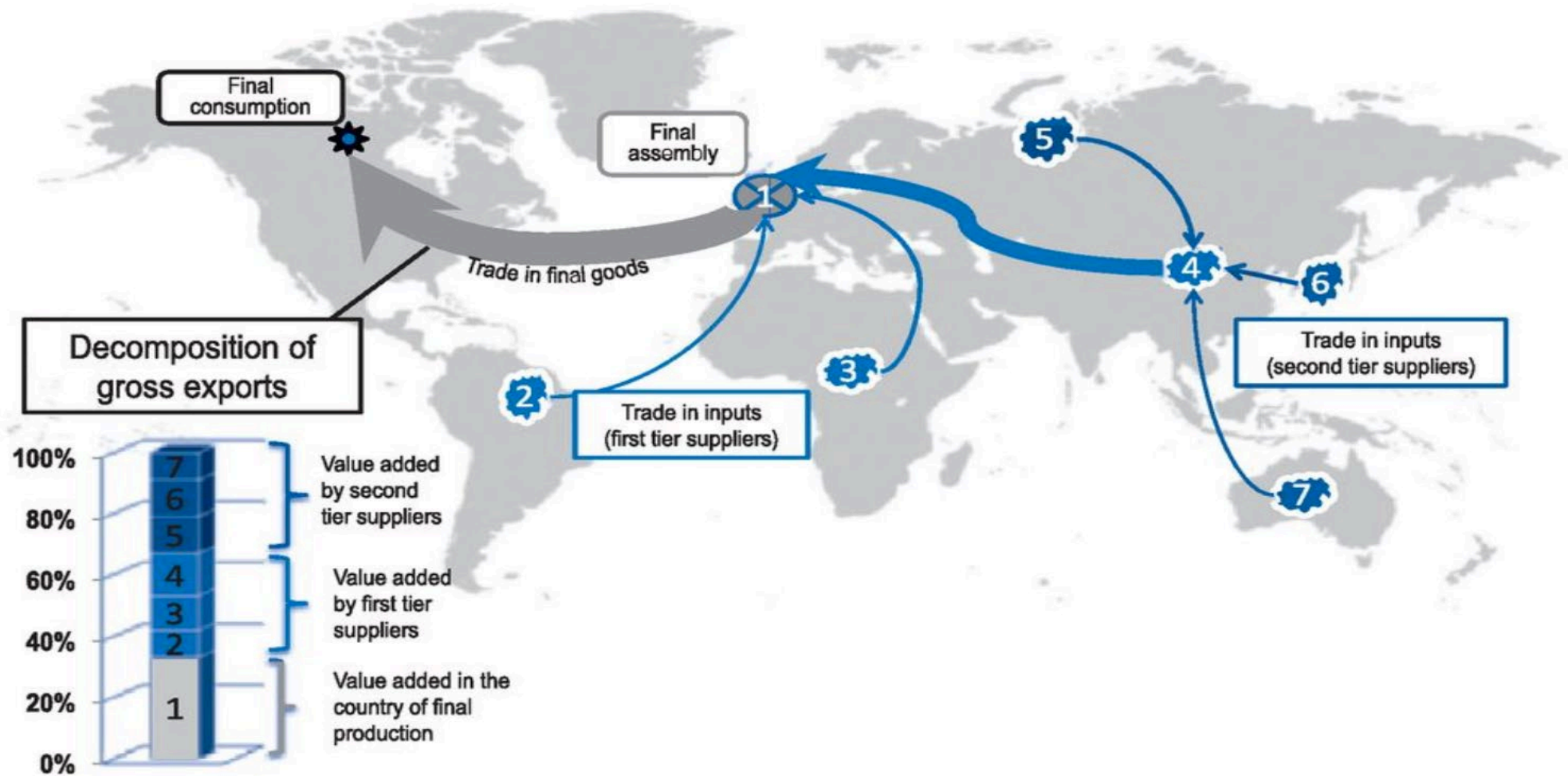
Outlet

1. Context
2. Literature on trade in value added
3. Input-Output table
4. Application in the context of tourism sectors
5. Outcomes
6. What is needed to get data/analysis
7. How to measure the DVA, GVC?
8. Quality of data
9. ECA contribution

Literature on trade in value added

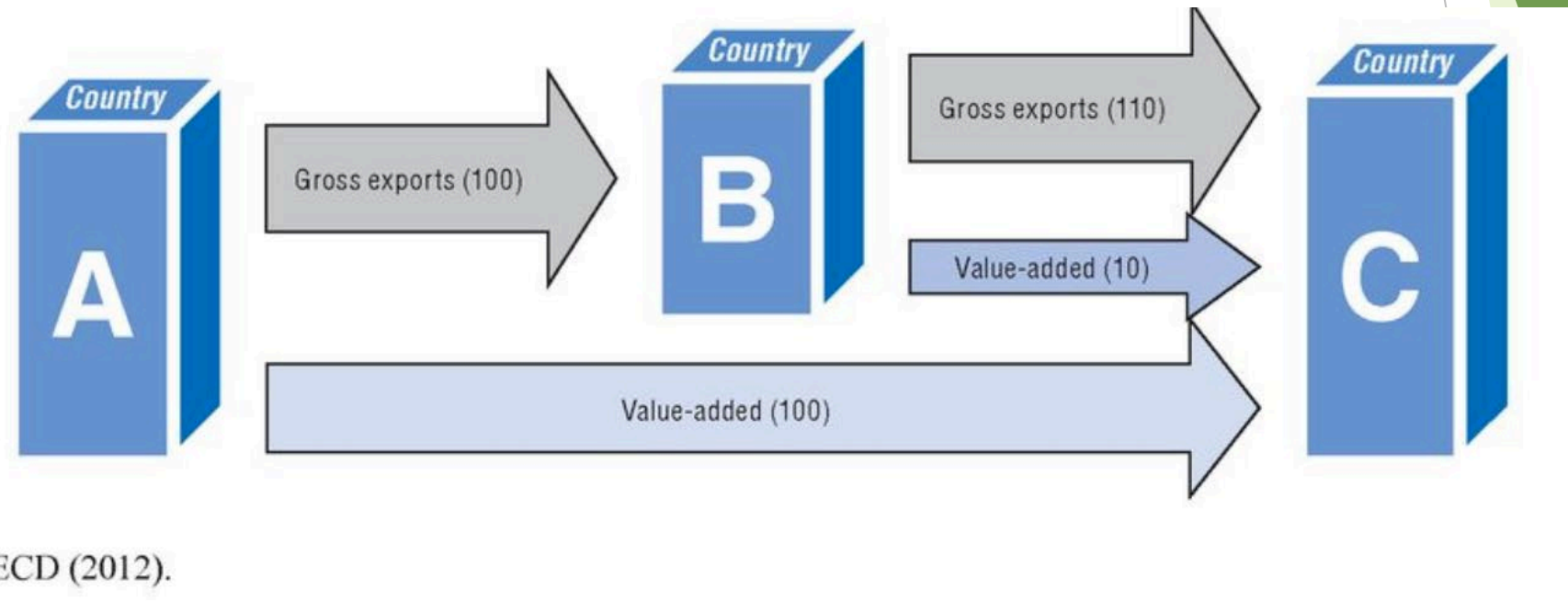
- ▶ Shepherd, B. GVCs Methodology Paper, Jan 2019, ...
- ▶ Aslam, A., N. Novta, and F. Rodrigues-Bastos. 2017. “Calculating Trade in Value Added.” Working Paper WP/17/178, IMF.
- ▶ Johnson, R., and G. Noguera. 2012. “Accounting for Intermediates: Production Sharing and Trade in Value Added.” *Journal of International Economics*, 86(2): 224-236.
- ▶ De Backer, K., and S. Miroudot. 2013. “Mapping Global Value Chains.” Trade Policy Paper No. 159, OECD.
- ▶ Jones, L., W. Powers, and R. Ubee. 2013. “Making Global Value Chain Research More Accessible.” Working Paper No. 2013-10A, US International Trade Commission.
- ▶ Low, P., and G. Pasadilla (eds). 2016. *Services in Global Value Chains: Manufacturing-Related Services*. Singapore: World Scientific.

Input-Output table



Source: OECD (2012). Map source: © ARTICQUE – all rights reserved.

Input-Output table



Input-Output table

- ▶ Input-Output Table: **Intermediate Use + Final Use = Production**

		Intermediate Use				Final Demand		Gross Output
		Country A		Country B		Country A	Country B	
		Sector 1A	Sector 2A	Sector 1B	Sector 2B	HouseholdsA	HouseholdsB	
Country A	Sector 1A	Intermediate use of domestic output	Intermediate use by 2A of domestic output from 1A	Intermediate use by 1B of exports from 1A	Intermediate use by 2B of exports from 1A	Final use of domestic output from 1A	Final use by B of exports from 1A	Production of 1A
	Sector 2A	Intermediate use by 1A of domestic output from 2A	Intermediate use of domestic output	Intermediate use by 1B of exports from 2A	Intermediate use by 2B of exports from 2A	Final use of domestic output from 2A	Final use by B of exports from 2A	Production of 2A
Country B	Sector 1B	Intermediate use by 1A of exports from 1B	Intermediate use by 2A of exports from 1B	Intermediate use of domestic output	Intermediate use of 2B of domestic output from 1B	Final use by A of exports from 1B	Final use of domestic output from 1B	Production of 1B
	Sector 2B	Intermediate use by 1A of exports from 2B	Intermediate use by 2A of exports from 2B	Intermediate use of 1B of domestic output from 2B	Intermediate use of domestic output	Final use by A of exports from 2B	Final use of domestic output from 2B	Production of 2B
		Total Intermediate use by 1A	Total Intermediate use by 2A	Total Intermediate use by 1B	Total Intermediate use by 2B	Final use by A	Final use by B	

Input-Output table

- ▶ **Example:** Consider 3 countries ($G=3$) and 4 sectors ($N=4$) in each country, so 12 sectors in all ($GN = 12$) as in the figure

Year: 2000

														Final Demand (FD) Matrix				
		Country 1				Country 2				Country 3				Country 1	Country 2	Country 3	Gross Output	Gross Exports
T matrix		Sector 1	Sector 2	Sector 3	Sector 4	Sector 1	Sector 2	Sector 3	Sector 4	Sector 1	Sector 2	Sector 3	Sector 4	Households	Households	Households		
Country 1	Sector 1	346	156	95	594	819	154	832	397	409	562	241	554	394	902	446	6,901	5,316
Country 1	Sector 2	354	443	7	908	42	92	561	839	470	770	83	368	514	694	512	6,657	4,431
Country 1	Sector 3	291	795	243	825	753	2	340	232	251	605	526	610	384	753	909	7,518	4,980
Country 1	Sector 4	637	259	289	813	500	716	947	645	856	221	898	41	91	653	301	7,868	5,778
Country 2	Sector 1	547	466	910	276	518	149	779	553	197	285	305	828	630	565	857	7,864	5,300
Country 2	Sector 2	752	936	822	638	611	496	98	924	608	689	872	972	847	209	37	9,511	7,173
Country 2	Sector 3	295	444	7	828	929	535	367	257	890	429	641	26	165	419	886	7,117	4,610
Country 2	Sector 4	113	518	791	459	79	748	254	218	586	673	424	157	800	355	501	6,677	5,022
Country 3	Sector 1	46	457	552	572	632	680	730	607	796	186	15	958	338	320	194	7,082	4,934
Country 3	Sector 2	962	96	544	96	675	113	711	337	787	571	241	211	479	14	608	6,445	4,027
Country 3	Sector 3	531	190	686	191	374	615	788	738	351	32	565	622	269	814	559	7,326	5,197
Country 3	Sector 4	857	776	897	18	915	482	308	458	253	145	982	270	700	822	729	8,612	6,233
																	89,578	
VA matrix																		
Country 1	Value Added	1,172	1,120	1,676	1,648	-	-	-	-	-	-	-	-	-	-	-	-	-
Country 2	Value Added	-	-	-	-	1,019	4,730	401	471	-	-	-	-	-	-	-	-	-
Country 3	Value Added	-	-	-	-	-	-	-	-	626	1,278	1,532	2,995	-	-	-	-	-
Total input		6,901	6,657	7,518	7,868	7,864	9,511	7,117	6,677	7,082	6,445	7,326	8,612	89,578				

Input-Output table

- ▶ Two parts: **Intermediate Use & Final Use**
- ▶ Many countries that interact
 - Production, gross Exportations, gross Importations, Values added, GVC participation Index, ...
- ▶ The Intermediate Use is square matrix
 - Same country-sectors on row and column
 - Intermediate Use of domestic output on diagonal parts
 - Off diagonal elements represent exports of intermediates
- ▶ Final consumption from output of each sector

Input-Output table

Difference between Supply-Use-Tables (SUTs) and Input-Output Tables

- ▶ In SUT, there are 2 tables: Supply Table (Production and Importation) and Use Table (Intermediate and Final Consumptions, and Exportation)
- ▶ In SUT, exportations and importations are aggregate, no need to know the origin while in Multi-Region Input Output (MRIO), it is needed to know the origin
- ▶ In MRIO, knowledge of the using of exportations and importations
 - Whether for intermediate or final uses,
 - Using by which sector for Intermediate Use
- ▶ The Intermediate Use in SUT is not square matrix
 - Products on row and industries on column
- ▶ National input-output tables is derived from harmonized national supply and use tables with international trade in goods and services statistics
- ▶ The SUTs is very useful to compile Input-Output table, but not enough. Information from foreign is necessary

Application in the context of tourism sectors

- ▶ **Quantifying the value generated in the tourism value chain makes it possible**
 - to identify which type of tourism activities - and tourists - add more value, .. (OECD, 2017)
 - better understanding of these bilateral exchanges (the direct and indirect impacts of tourism)
 - identification of **source markets** which generate more value added in the domestic economy.
 - **how** upstream domestic industries (backward linkages) contribute to tourism exports

Application in the context of tourism sectors

- ▶ **Quantifying the value generated in the tourism value chain makes it possible**
 - help to respond to key policy/statistics questions such as:
 - ❖ How much value does tourism add to economies?
 - ❖ Does tourism create additional trade?
 - ❖ Do tourism services have 'high or low' domestic value added content?
 - ❖ How does tourism compare to the rest of the economy?
 - ❖ What is the upstream impact of tourism on other domestic industries?

Application in the context of tourism sectors

- ▶ Tourism is not identified as a separate sector in CPC, ISIC, or in common sectoral classifications used in trade data or the national accounts.
- ▶ There are two ways to measure Tourism Value Chains:
 - ❖ We can do is to look at “hotels and restaurants”, knowing that this is a sector that is heavily involved in tourism.
 - But package tours, travel, and other tourist and recreational services are split across other sectors.
 - Generally used in Africa to measure Tourism Value Chains
 - ❖ Modify the Input-Output Table in decomposing Final Uses by Final Use by residents and final uses by non-residents

Application in the context of tourism sectors

Input-Output Table in the context of tourism sectors

at basic prices

		Intermediate demand						Final consumption and capital formation			Direct purchases by non-residents			Output
		Country A		Country B		Country C		Country A	Country B	Country C	Country A	Country B	Country C	
		Ind 1	Ind 2	Ind 1	Ind 2	Ind 1	Ind 2							
Country A	Ind 1												X(A1)	
	Ind 2												X(A2)	
Country B	Ind 1												X(B1)	
	Ind 2												X(B2)	
Country C	Ind 1												X(C1)	
	Ind 2												X(C2)	
<i>Taxes less subsidies...</i>		... on intermediate products						... on final products						
		NTZA1	NTZA2	NTZB1	NTZB2	NTZC1	NTZC2	FA	FB	FC	FA	FB	FC	
Value added		V(A1)	V(A2)	V(B1)	V(B2)	V(C1)	V(C2)							
Output		X(A1)	X(A2)	X(B1)	X(B2)	X(C1)	X(C2)							

International tourism activities captured here

Key:

Cross-border flows of intermediate goods and services

Domestic flows of intermediate goods and services

Cross-border flows of final goods and services

Domestic flows of final goods and services

Source: OECD Directorate for Science, Technology and Innovation.

Application in the context of tourism sectors













Input-Output Tables in the context of tourism sectors

- ▶ From a tourism perspective, a key component from the harmonized national input-output tables is the data on direct purchases by non-residents.
- ▶ Another feature is the identification of resident expenditures abroad in the national input-output tables.
- ▶ Identify main sectors used by non-residents (like Accommodation, food services, transportation, ...)
- ▶ Need other sectors that are indirectly used by non-residents (like Finance & Insurance, Agriculture, ...)
- ▶ Identify main countries of non-residents

Application in the context of tourism sectors

Tourism sectors

- ▶ Differ following countries
- ▶ Main sectors used by non-residents
- ▶ For example, for Canada (2012) and UK (2010),

 Accommodation and food services	 Education services	 Real estate	 Sport, amusement and recreation
 Air transport	 Mining and quarrying	 Textiles	 Furniture & other Manuf.
 Food, beverages & tobacco	 Land transport	 Rental and leasing	 Other

Main tourism sectors include:

1. Accommodation services for visitors
2. Food and beverage serving services
3. Railway passenger transport services
4. Road passenger transport services
5. Water passenger transport services
6. Air passenger transport services
7. Transport equipment rental services
8. Travel agencies and other reservation services
9. Cultural services
10. Sports and recreational services
11. Country-specific tourism characteristic goods
12. Country-specific tourism characteristic services

For Gambia, according data, main sectors are:

- Hotels
- Bars and restaurants
- Beach bars
- Guest houses/lodges & motels
- Ground tour operators
- Casinos, gaming and betting houses
- Equipment hirers
- Retail shop/services
- Taxi
- Supermarket

How to measure the DVA, GVC?

AX Y X
↓ ↓ ↓

Year: 2000

T matrix		Country 1				Country 2				Country 3				Final Demand (FD) Matrix			Gross Output	Gross Exports	
		Sector 1	Sector 2	Sector 3	Sector 4	Sector 1	Sector 2	Sector 3	Sector 4	Sector 1	Sector 2	Sector 3	Sector 4	Country 1 Households	Country 2 Households	Country 3 Households			
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Total input		6,901	6,657	7,518	7,868	7,864	9,511	7,117	6,677	7,082	6,445	7,326	8,612	89,578					

How to measure the DVA, GVC?

- ▶ Starting from $AX + Y = X$, we can perform some rearrangements, and solve for X :

- ▶ $Y = X - AX$

- ▶ $\therefore X = (I - A)^{-1}Y \equiv BY$

- ▶ \hat{V} as the value added coefficients matrix:

- ▶ E with gross exports by country-sector on the main diagonal, and zeros elsewhere

- ▶ $T_v = \hat{V}BE = \begin{bmatrix} \hat{v}_1 & 0 & \cdots \\ 0 & \hat{v}_2 & 0 \\ \vdots & 0 & \ddots \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} & \cdots \\ b_{21} & b_{22} & \cdots \\ \vdots & \vdots & \ddots \end{bmatrix} \begin{bmatrix} e_1 & 0 & \cdots \\ 0 & e_2 & 0 \\ \vdots & 0 & \ddots \end{bmatrix}$

How to measure the DVA, GVC?

- ▶ For application, many softwares could be used. UNCTAD has developed a methodology on R
- ▶ For tourism sector,
 - ❖ 1st way: Use the row and column of hotels and restaurants,
 - ❖ 2nd way: Use expenditures of non-resident instead of gross exports with modification related
- ▶ *The knowledge sharing platform of the project there is an online course which will facilitate the learning of the quantitative tool.*

Outcomes

Allow to know the **requirements for an extra unit of output in each country-sector**. If a sector in a country needs an extra unit of output:

- ▶ Determine the direct input requirements for each country-sector: **input-output coefficients or matrix of technical coefficients**

A	C1: S1	C1: S2	C1: S3	C1: S4	C2: S1	C2: S2	C2: S3	C2: S4	C3: S1	C3: S2	C3: S3	C3: S4
Country 1: S1	0.050	0.023	0.013	0.076	0.104	0.016	0.117	0.059	0.058	0.087	0.033	0.064
Country 1: S2	0.051	0.067	0.001	0.115	0.005	0.010	0.079	0.126	0.066	0.119	0.011	0.043
Country 1: S3	0.042	0.119	0.032	0.105	0.096	0.000	0.048	0.035	0.035	0.094	0.072	0.071

- ▶ Determine the total (direct & indirect) input requirements for each country-sector:

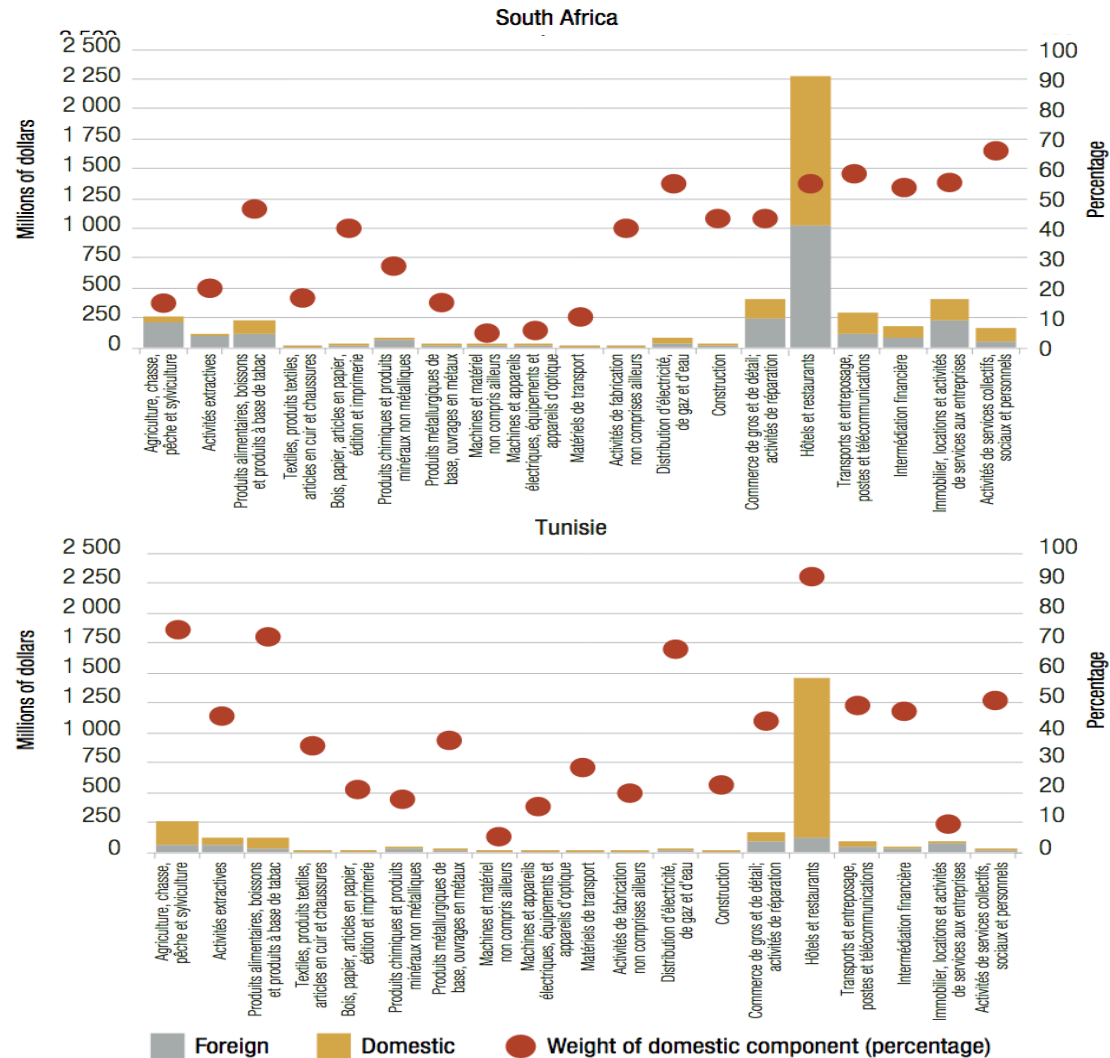
	C1: S1	C1: S2	C1: S3	C1: S4	C2: S1	C2: S2	C2: S3	C2: S4	C3: S1	C3: S2	C3: S3
Country 1: S1	1.272	0.241	0.223	0.295	0.349	0.159	0.389	0.306	0.321	0.304	0.243
Country 1: S2	0.266	1.276	0.201	0.336	0.237	0.154	0.346	0.367	0.334	0.340	0.214
Country 1: S3	0.279	0.346	1.250	0.338	0.345	0.147	0.340	0.302	0.308	0.324	0.291

Outcomes

- ▶ The **Domestic Value Added (DVA) in exports** are the value added in exports whose the outputs are produced by domestic industries
- ▶ The **Foreign Value Added (FVA) in exports** are the value added in exports whose the outputs are produced by foreign industries
 - ▶ Known as “**VS**” in the **technical literature**.
 - ▶ Known of **backward participation** in the **policy literature**
- ▶ The **Indirect Domestic Value added (DVX) in exports**, i.e., Value Added that is embodied in the exports of other countries, upstream contributions of DVA of other industries
 - ▶ Known as “**VS1**” in the **technical literature**.
 - ▶ Known as **forward linkages** in the **policy literature**.
- ▶ **GVC Participation Index** that is the best indicator which shows how the sector involved in RVCs/GVCs through both backward and forward linkages.

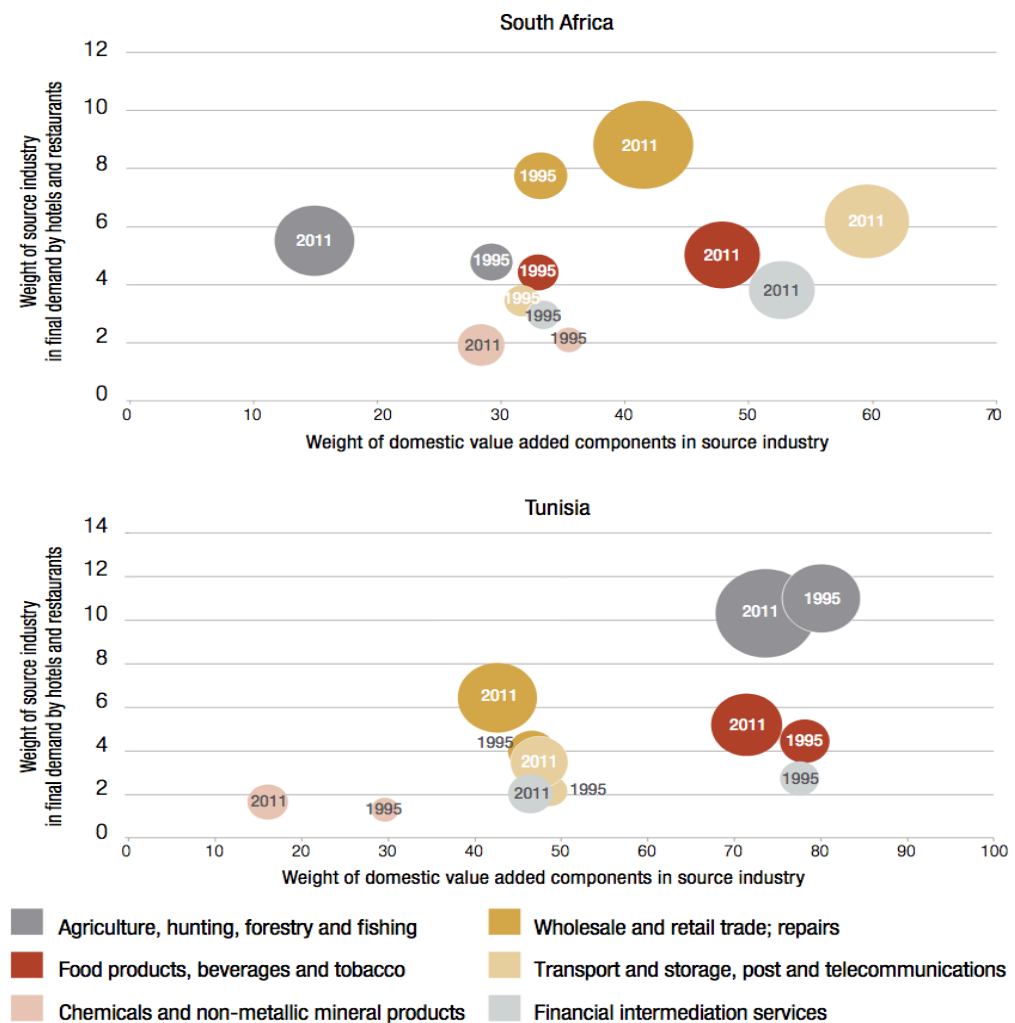
Outcomes

Value added content in final demand by hotels and restaurants sector, by source industry and origin, selected countries, 2011



Outcomes

Evolution of selected intersectoral linkages with hotels and restaurants sector, South Africa and Tunisia, 1995 and 2011

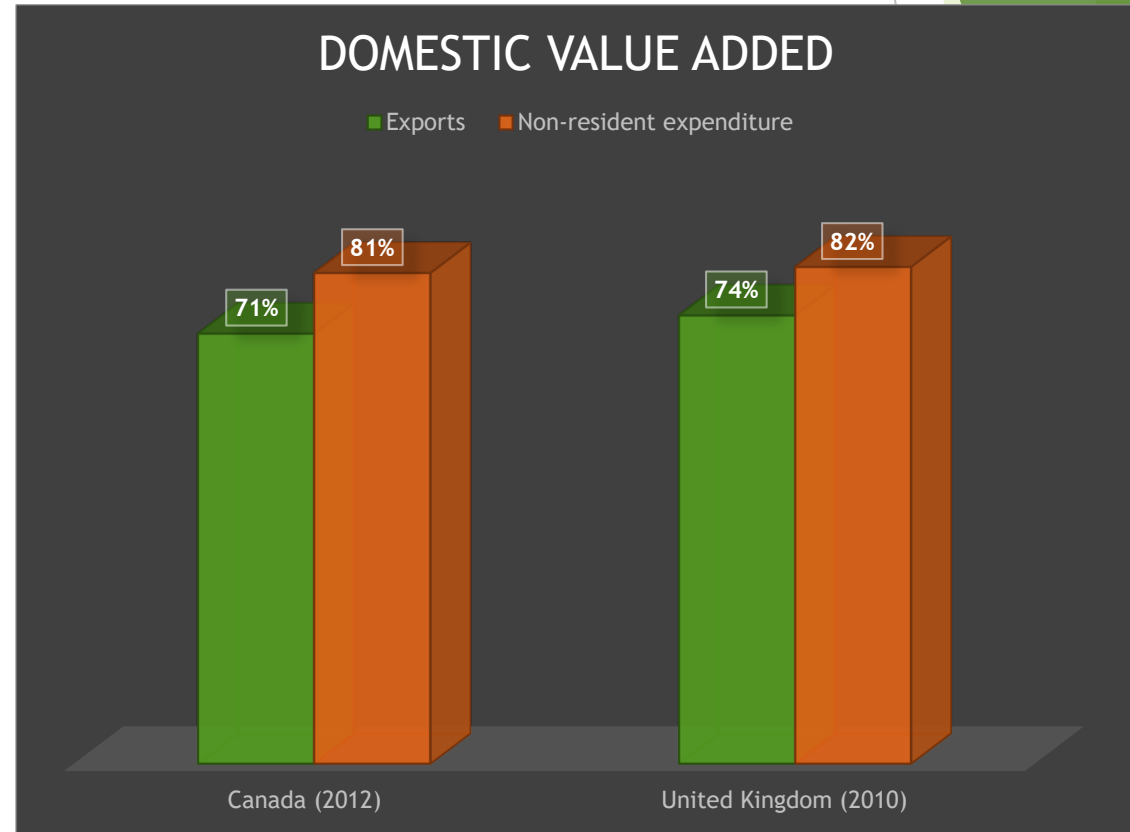


Source: UNCTAD calculations, based on OECD and UNWTO, 2017.

Outcomes

Domestic Value Added generated by tourism sectors

- ▶ Whereas 1 CAD of exports generates 71 cents of Canadian value added, 1 CAD of non-resident expenditure generates 81 cents of Canadian value added.
- ▶ In the United Kingdom, whereas 1 GBP of exports generates 74 pence of value added, 1 GBP of non-resident expenditures generates 82 pence of value added.

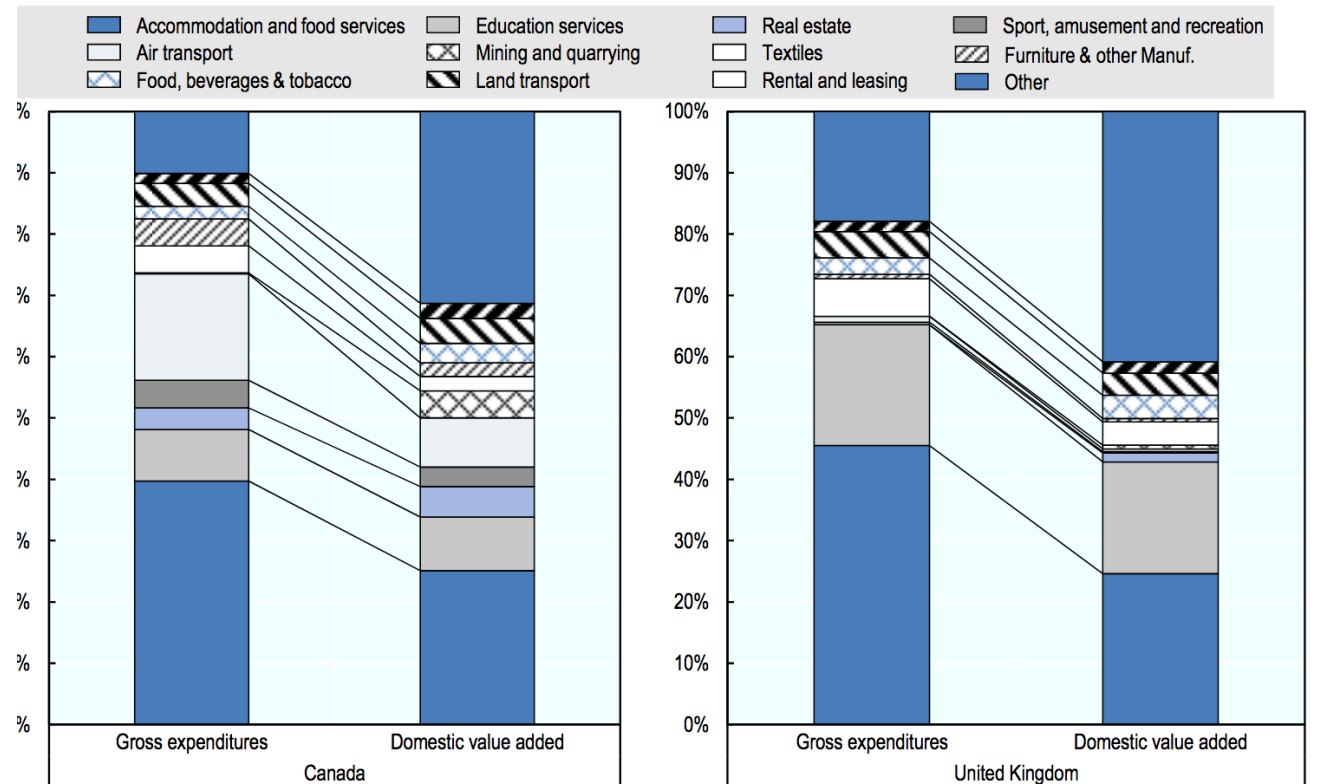


Outcomes

Domestic Value Added generated by tourism sectors

- ▶ Whereas nearly 40% of non-resident expenditures are spent on accommodation and food services in Canada, this share is only 27% in value added terms.
- ▶ A similar pattern is found in the UK, where these expenditures account for 46% of total non-resident expenditures in gross value terms, falling to 25% when measured in value added terms.

Components of tourism sectors: Gross Exports vs DVA

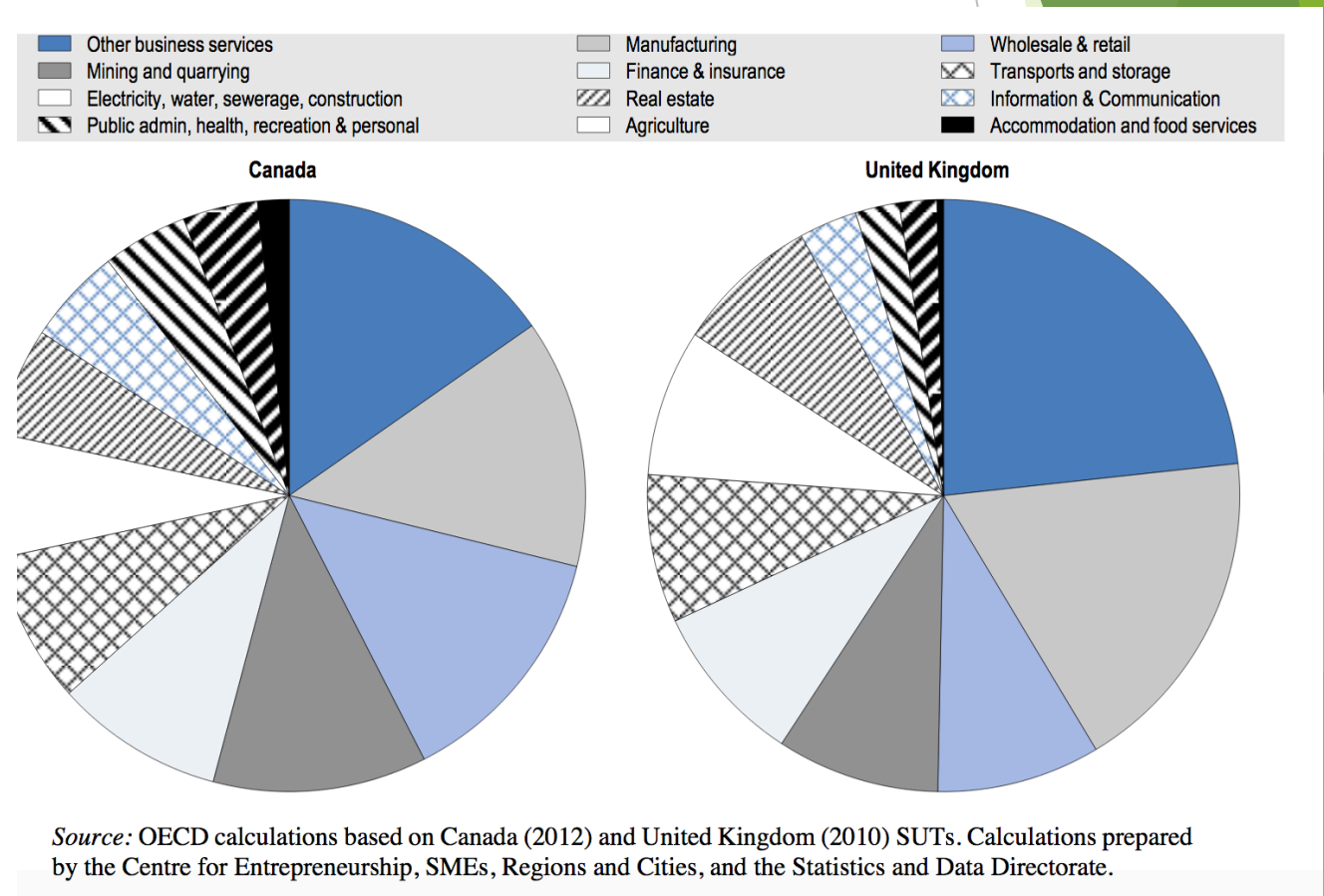


Source: OECD calculations based on Canada (2012) and United Kingdom (2010) SUTs. Calculations prepared by the Centre for Entrepreneurship, SMEs, Regions and Cities, and the Statistics and Data Directorate.

Outcomes

Indirect domestic value added generated by non-resident tourism expenditures

- ▶ Overall, in Canada each CAD of direct value added generated by non-resident expenditure generates an additional 70 cents of upstream value added.
- ▶ In the United Kingdom, each GBP of direct value added generated by non-resident expenditure generates an additional 48 pence of upstream value added.



What is needed to get data/analysis

▶ National supply and use tables

- ❖ the domestic purchases by non-residents are specified not only in terms of the total expenses, but also by detailed product, as a subcomponent of household consumption expenditure.

▶ Bilateral trade flow statistics

- ❖ with bilateral trade in tourism services statistics broken down by detailed product and country of origin of tourists.
- ❖ Tourists from different countries have different expenditure patterns,
- ❖ and analyzing these from a value added perspective may additionally provide insights for policy makers.

▶ Tourism Satellite Account

- ❖ which can be used to develop estimates of the value added created by tourism in countries in the absence of detailed information in the supply and use tables on the expenditures of non-residents by products.

7. Quality of data

Bases on some questions:

1. Is the data publicly available for stakeholders and users?
 - ❖ In which format (Excel, Stata, Word, PDF, html, ...)?
 - ❖ Need to register?
 - ❖ Need password?
2. When was the most recent data produce?
3. How frequently is the data produced? (Quarterly, Annually, 5 years)
4. What methodology is used?
 - ❖ Are international guidelines followed?
 - ❖ Are International classification used (CPC, ISIC)?
5. Are data comparable year to year? Is the same methodology used each year?
6. Is there metadata?
7. Is data collected or estimated?



7. Quality of data

- ▶ **Prerequisites of quality.** Prerequisites of **quality** refer to all institutional and organizational conditions that have an impact on the quality of tourism statistics. These include:
 - ❖ the legal basis for compilation of data;
 - ❖ the adequacy of data sharing and coordination among data producing agencies;
 - ❖ assurance of confidentiality;
 - ❖ the adequacy of human, financial, and technical resources for implementation of tourism statistics programmes and implementation of measures to ensure the cost-effective; and
 - ❖ quality awareness;
- ▶ **Relevance.** The relevance of tourism statistics reflects the degree to which tourism statistics **meet users' needs.**
 - ❖ **Absence of significant gaps between the key user needs and compiled tourism statistics** in terms of variables, coverage and details is an indicator of relevance;
- ▶ **Credibility.** The credibility of tourism statistics refers to the **confidence** that users place in the data based on the image of the agency responsible for production and dissemination of the data.
 - ❖ Indicators of credibility should provide evidence that production of tourism statistics is not manipulated and that their release is not timed in response to political pressure;



7. Quality of data

- ▶ **Accuracy.** The accuracy of tourism statistics is the degree to which the **data correctly estimate or describe the quantities or characteristics** they are designed to measure.
 - ❖ In general, accuracy can be characterized in terms of errors in statistical estimates and is traditionally decomposed into bias (systematic error) and variance (random error) components.
 - ❖ **Validity** refers to whether a data collection tool or concept truly captures what it is intended to measure. In other words, a variable or measure is valid if the values estimated are close to the true values
 - ❖ **Reliability** of data refers to whether the instrument or source of the data would produce consistent results under identical circumstances regardless of who uses it.
 - ❖ **Precision** refers to an aspect of the reporting of data, or of statistics or indices derived from original data and is not, in itself, an intrinsic quality of the original data.



7. Quality of data

- ▶ **Timeliness.** The timeliness of tourism statistics refers to the delay between the end of the reference period to which the data pertain and the date on which the data are released and available to the public.
 - ❖ This dimension usually involves a trade-off against accuracy. The timeliness of information also influences its relevance, as accurate data that are not timely are of limited usefulness;
- ▶ **Methodological soundness.** The methodological soundness of a data source refers to the application of international standards, guidelines and good practices in production of tourism statistics.
 - ❖ **Metadata** provided along with tourism statistics play a crucial role for assessing the methodological soundness of data
 - ❖ The methodological soundness is closely related to the interpretability of data.

7. Quality of data

- ▶ **Coherence.** Coherence reflects the degree to which the data are logically connected and mutually consistent, that is, they can be successfully brought together with other statistical information within a broad analytical framework and over time.
 - ❖ The use of standard concepts, classifications and target populations promotes coherence, as does the use of common methodology across surveys when relevant.
 - ❖ Coherence has four important subdimensions:
 - (i) **Coherence within a data set** implies that the elementary data items are based on compatible concepts, definitions and classifications and can be meaningfully combined;
 - (ii) **Coherence across data sets** implies that the data are based on common concepts, definitions and classifications, or that any differences are explained and can be allowed for;
 - (iii) **Coherence over time** implies that the data are based on common concepts, definitions and methodology over time, or that any differences are explained and can be allowed for; and
 - (iv) **Coherence across countries** implies that the data are based on common concepts, definitions and methodology over countries, or that any differences are explained and can be allowed for;

7. Quality of data

- ▶ **Accessibility.** The accessibility of tourism statistics refers to the ease with which they can be obtained from those agencies active in tourism statistics.
 - ❖ This includes the ease with which the existence of information can be ascertained, as well as the suitability of the form or the media of dissemination through which the information can be accessed.
 - ❖ Accessibility requires the development of an advance release calendar so the users will be informed well in advance about when the data will become available, and where and how to access them.
 - ❖ The availability of metadata significantly improves accessibility and is, together with the existence of user support services, an indicator of this quality dimension.

ECA contribution

Use of input-output tables in countries with similar structure

- ▶ In Africa, only 29 countries out of 54 African countries have at least a Supply Use Table,
- ▶ 25 African countries have never compiled Supply Use Table,
- ▶ UNECA is estimating Supply Use Tables for these 25 African countries,
- ▶ Using technical coefficients (shares of outputs used as intermediate use) to build Intermediate consumption for each industry
- ▶ Countries with similar structure of industrial development
 - It can be one country or a group of countries
- ▶ With the same manner, it is possible to estimate input-out tables, but:
 - ❖ These estimations are inevitably biased,
 - ❖ The best compilations are from surveys

ECA contribution

ECA capacity building

- ▶ Three phases:
 - ❖ E-trainings to form a large participants with little costs
 - ❖ Seminar face-to-face
 - ❖ Workshops and follow-up activities
- ▶ Official requests of the country
- ▶ Fill questionnaires of data availability

Conclusion

- ▶ Steps for the quantitative approach:
 - ❖ Building the Input-Output Table,
 - ❖ Using algebraic models or application in software,
 - ❖ Know the outcomes,
- ▶ Two ways to measure Tourism Value Chains:
 - ❖ Use “hotels and restaurants”
 - ❖ Use expenditures of non-residents
- ▶ Quality of data

Thank You

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect against the white background.