Measuring value chains - Use of input-output tables

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

23-24 May 2019
Coco Ocean Resort, Bijilo, The Gambia
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, ...
Input-Output table

Decomposition of gross exports

Value added by second tier suppliers
Value added by first tier suppliers
Value added in the country of final production

Trade in inputs (second tier suppliers)
Trade in final goods
Final assembly
Final consumption

Source: OECD (2012). Map source: © ARTICQUE – all rights reserved.
Input-Output table

Source: OECD (2012).
## Input-Output Table: Intermediate Use + Finale Use = Production

<table>
<thead>
<tr>
<th></th>
<th>Intermediate Use</th>
<th>Final Demand</th>
<th>Gross Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Country A</td>
<td>Country B</td>
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<tr>
<td></td>
<td>Sector 1A</td>
<td>Sector 1B</td>
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<td>Country A</td>
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<tr>
<td>Sector 1A</td>
<td>Intermediate use of domestic output</td>
<td>Intermediate use by 2A of domestic output from 1A</td>
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<td>Intermediate use by 1B of exports from 1A</td>
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<td>Intermediate use by 2B of exports from 1A</td>
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<td>Final use of domestic output</td>
<td>Final use by B of exports from 1A</td>
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<td>Final use by A of exports from 1B</td>
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<td>Production of 1A</td>
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<td>Country B</td>
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<td>Final use of domestic output</td>
<td>Final use by B of exports from 1B</td>
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<td>Final use by A of exports from 1B</td>
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<td>Production of 1B</td>
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<td>Intermediate use by 2A of domestic output</td>
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<td>Intermediate use by 1B of exports from 2B</td>
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<td>Intermediate use by 2B of exports from 2B</td>
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<td>Final use of domestic output</td>
<td>Final use by B of exports from 2B</td>
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<td>Production of 2B</td>
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<td>Total Intermediate use by 1B</td>
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<td>Total Intermediate use by 2B</td>
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<td>Final use by A</td>
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<tr>
<td></td>
<td></td>
<td>Final use by B</td>
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</tr>
</tbody>
</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.

<table>
<thead>
<tr>
<th>Year 2000</th>
<th><strong>T matrix</strong></th>
<th><strong>Country 1</strong></th>
<th><strong>Country 2</strong></th>
<th><strong>Country 3</strong></th>
<th><strong>Country 1</strong></th>
<th><strong>Country 2</strong></th>
<th><strong>Country 3</strong></th>
<th><strong>Final Demand (FD) Matrix</strong></th>
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<th><strong>Country 2</strong></th>
<th><strong>Country 3</strong></th>
<th><strong>Gross Output</strong></th>
<th><strong>Gross Exports</strong></th>
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<td>145</td>
<td>982</td>
<td>270</td>
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</tbody>
</table>

**VA matrix**

| **Country 1** | **Value Added** | 1,172 | 1,120 | 1,676 | 1,648 | -     | -     | -     | -     | -     | -     | -     | -     | -     | 89,578 |
| **Country 2** | **Value Added** | -     | -     | -     | -     | 1,019 | 4,730 | 401   | 471   | -     | -     | -     | -     | -     | 626   |
| **Country 3** | **Value Added** | -     | -     | -     | -     | -     | -     | -     | -     | 626   | 1,278 | 1,532 | 2,995 | -     | -     |

| **Total input** | **Country 1** | 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 |

| **Country 2** | - | - | - | - | 1,019 | 4,730 | 401 | 471 | - | - | - | - | 89,578 |
| **Country 3** | - | - | - | - | - | - | - | - | 626 | 1,278 | 1,532 | 2,995 | - | - | 89,578 |
Input-Output table

- Two parts: Intermediate Use & Finale 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

<table>
<thead>
<tr>
<th>Intermediate demand</th>
<th>Final consumption and capital formation</th>
<th>Direct purchases by non-residents</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ind 1</td>
<td>Ind 1</td>
<td>Ind 1</td>
<td>X(A1)</td>
</tr>
<tr>
<td>Ind 2</td>
<td>Ind 2</td>
<td>Ind 2</td>
<td>X(A2)</td>
</tr>
<tr>
<td>Country B</td>
<td>Country C</td>
<td></td>
<td>X(B1)</td>
</tr>
<tr>
<td>Ind 1</td>
<td>Ind 1</td>
<td>Ind 1</td>
<td>X(B2)</td>
</tr>
<tr>
<td>Country C</td>
<td>Country B</td>
<td></td>
<td>X(C1)</td>
</tr>
<tr>
<td>Ind 1</td>
<td>Ind 1</td>
<td>Ind 1</td>
<td>X(C2)</td>
</tr>
</tbody>
</table>

Taxes less subsidies...

<table>
<thead>
<tr>
<th>Value added</th>
<th>Output</th>
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<td>NTZA1</td>
<td>NTZA2</td>
</tr>
<tr>
<td>NTZB1</td>
<td>NTZB2</td>
</tr>
<tr>
<td>NTZC1</td>
<td>NTZC2</td>
</tr>
<tr>
<td>V(A1)</td>
<td>X(A1)</td>
</tr>
<tr>
<td>V(A2)</td>
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<td>X(B2)</td>
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<td>X(C1)</td>
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<tr>
<td>V(C2)</td>
<td>X(C2)</td>
</tr>
</tbody>
</table>

International tourism activities captured here

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),

- 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

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
How to measure the DVA, GVC?

<table>
<thead>
<tr>
<th>Year: 2000</th>
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<tbody>
<tr>
<td><strong>T matrix</strong></td>
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</tr>
<tr>
<td>Country 1</td>
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<tr>
<td>Country 2</td>
</tr>
<tr>
<td>Country 3</td>
</tr>
<tr>
<td>Country 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Final Demand (FD) Matrix</strong></th>
<th><strong>Households</strong></th>
<th><strong>Households</strong></th>
<th><strong>Households</strong></th>
<th><strong>Gross Output</strong></th>
<th><strong>Gross Exports</strong></th>
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<tbody>
<tr>
<td>Country 1</td>
<td>6,901</td>
<td>6,657</td>
<td>7,518</td>
<td>7,868</td>
<td>7,864</td>
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<td>6,657</td>
<td>6,431</td>
<td>6,901</td>
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<td>4,880</td>
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<table>
<thead>
<tr>
<th><strong>VA matrix</strong></th>
<th><strong>Value Added</strong></th>
<th><strong>Value Added</strong></th>
<th><strong>Value Added</strong></th>
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<tr>
<td>Country 1</td>
<td>1,172</td>
<td>1,120</td>
<td>1,676</td>
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<td>Country 2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Country 3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Total input: 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

$$T_v = \hat{V}BE = \begin{bmatrix} \hat{v}_1 & 0 & \cdots & b_{11} & b_{12} & \cdots \\ 0 & \hat{v}_2 & 0 & b_{21} & b_{22} & \cdots \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots \\ e_1 & 0 & \cdots & 0 & e_2 & 0 \end{bmatrix}$$
How to measure the DVA, GVC?

- For application, many softwares could be used. UNCTAD has developed a methodology on R

- For tourism sector,
  - 1\textsuperscript{st} way: Use the row and column of hotels and restaurants,
  - 2\textsuperscript{nd} 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

<table>
<thead>
<tr>
<th></th>
<th>C1: S1</th>
<th>C1: S2</th>
<th>C1: S3</th>
<th>C1: S4</th>
<th>C2: S1</th>
<th>C2: S2</th>
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<th>C3: S2</th>
<th>C3: S3</th>
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<td>0.035</td>
<td>0.094</td>
<td>0.072</td>
<td>0.071</td>
</tr>
</tbody>
</table>

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

- South Africa
- Tunisia

Legend:
- Foreign
- Domestic
- Weight of domestic component (percentage)
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.

*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.*
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 additional 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.
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