Global Value Chain Analysis: Data Requirements, Gaps & Improvements with New Datasets

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Presentation based on discussion paper prepared by Stacey Frederick, Ph.D., Research Scientist, Duke CGGG

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Overview

1) Data needed for GVC studies
   • Value chain model

2) Improvements to GVC analysis with
   • TiVA for Domestic Backward Linkages
   • I-O Tables for VC Mapping
   • Business Functions

3) GVC case study examples
   • Governance Typology
   • Costa Rica Medical Devices GVC
   • Mexico GVC and Clusters Study
   • U.S. Value Chains for Jobs and Wages
Introduction

• Proliferation of research labeled as “GVC” over the last 5-10 years
• All related to production fragmentation, but different motives, approaches and definitions of GVCs
• Three main groups involved
  – Social science & geography academic research centers (originators of GVC and GPN frameworks)
  – Economists & national statistics offices (from original firm-level VC approach to new I-O, DCE, TiVA efforts)
  – International NGOs and national governments (funders/implementers)
• Benefits from combining (a) theoretical insights and industry experience from ‘traditional” GVC researchers and (b) data availability and analysis from economists and statistics agencies
Dimensions of GVC Analysis

For a specific industry, good or service

- Input-output structure (firms and products)
  - Physical transformation (supply chain, end markets)
  - Intangible activities (value-adding activities)
- Geography (countries)
- Governance (lead firms and organizations)
- Industry stakeholders (firms & organizations along chain)
- Institutional context
- Upgrading (functions, products & markets)

GVC Data Requirements

Global

National/Local
Four Parts of Value Chain Model

SUPPLY CHAIN STAGES

Raw Materials | Components | Final Products | Distribution & Sales | Markets

Agriculture Forestry & Fishing (A) | Manufacturing (C) | Manufacturing (C) | Wholesale & Retail Trade (G) | Markets

Mining & Quarrying (B) | Financial and insurance activities (K) | | Transport & Storage (H) | MARKET

Universities & Education (P) | Utilities (D, E) | Information and communication (J) | Admin & support service activities (N) | MARKET

Professional, scientific and technical activities (M) | END MARKETS/BUYERS & SUPPORTING INDUSTRIES

Source: Frederick, S. (2014). Represents ISIC 4 sections
Data Needed for GVC Analysis

*Country-level data on*

1) Economic activity (industry) of establishments
2) Products/services (traded and domestic)
3) End buyer markets (for intermediates)
4) Supply chain position (input-output flow)
   – Raw materials, intermediates, final products, retail/sales
5) Value-adding activities (or business functions), establishments
6) Occupations (optional)
# GVC Dimensions: Current & Proposed Data Sources

<table>
<thead>
<tr>
<th>GVC Dimensions</th>
<th>Current</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input-output structure</strong></td>
<td>Interviews; secondary lit.</td>
<td>I-O TBLs</td>
</tr>
<tr>
<td>• Physical transformation</td>
<td></td>
<td>Business Functions; input categories in I-O TBLs</td>
</tr>
<tr>
<td>• Value-adding activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geography</strong></td>
<td>Trade data (UN Comtrade)</td>
<td>Business Functions; AMNE</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lead Firms</td>
<td>Interviews; market reports</td>
<td>Requires <em>firm-specific</em> data</td>
</tr>
<tr>
<td>• Institutions</td>
<td>Interviews; secondary lit.</td>
<td>(not focus for this presentation)</td>
</tr>
<tr>
<td><strong>Industry Stakeholders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Upgrading</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Functional</td>
<td>Interviews; secondary lit.</td>
<td>Business Functions</td>
</tr>
<tr>
<td>• Linkages</td>
<td>Interviews; secondary lit.</td>
<td>TiVA; DCE; I-O TBLs</td>
</tr>
<tr>
<td>• End markets</td>
<td>Interviews; secondary lit.</td>
<td>Trade data + I-O TBLs; BTDIxE</td>
</tr>
<tr>
<td>• Products</td>
<td>Trade data</td>
<td>(using EUC)</td>
</tr>
<tr>
<td><strong>Objective:</strong></td>
<td>Quantifying or finding ways to measure “qualitative” analysis.</td>
<td></td>
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</tbody>
</table>
Apparel Value Chain

Increasing Economic Value-Added

Inputs: Natural & Synthetic Fibers, Trim (Buttons, Zippers, Elastic, etc.), Equipment & Machinery

Components (Textiles): Yarn Production, Fabric Production

Final Products: Apparel Production (Cut & Sew), Knit, Woven

Distribution, Sourcing & Sales: Logistics & Sourcing: 5-10%, Design, Branding, & Retail: 60-75%

Intermediaries: Lead Firms

Lead Firms: Brand Manufacturers, Brand Marketers, Retailers

"Services" account for 70-80% of value-added – fall outside of ISIC 18 (apparel manufacturing)

Red indicates highest value-added activities + control/power over the chain

Percentages represent relative shares of apparel retail selling price attributed to value-adding activities.

Tangible Activities

Increasing Value-Added

Intangible Activities
**Detail** needed to achieve minimum categories

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Components (Textiles)</th>
<th>Final Products</th>
<th>Distribution, Sourcing &amp; Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural &amp; Synthetic Fibers</td>
<td>Yarn Production</td>
<td>Fabric Production</td>
<td>Apparel Production (Cut &amp; Sew)</td>
</tr>
<tr>
<td>Thread</td>
<td>Knit</td>
<td>Woven</td>
<td>Intermediaries</td>
</tr>
<tr>
<td>Lead Firms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand Manufacturers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand Marketers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retailers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of detail needed can be reached by using **6-digit HS codes or potentially 6-digit NAICS** (more detailed extension of ISIC). However required significant re-categorizing.

Lead firms are either labeled as manufacturers even if they don’t manufacture, or are labeled as generic “wholesale” or “retail”
Purpose of this slide:

1. Level of detail needed to map an industry’s supply chain (NAICS);
2. Orange boxes indicate NON-apparel end markets (different ISIC); can identify these using I-O tables.
Even the best possible categorizations using ISIC do not provide adequate detail.
Textile components are grouped with final products and knit fabric classified at 3-digit level with non-apparel end-uses (and was not separated from knit apparel in ISIC Rev. 3). Also not a connection to upstream and more importantly, downstream segments.
Value Chain Model correlated to ISIC: Value-Adding Activities & Supporting Industries

- Research & Development
- Design & Development
- Production/Operations/Industries
- Distribution & Logistics
- Sales & Marketing

Buyers/Markets

- Goods
  - 01-03
  - 05-09
  - 10-33
  - 73
  - 7420
  - 8230

- Services
  - 41-43
  - 49-53

• ISIC loosely represents parts of the VC model, but isn’t industry-specific.
• Industries primarily associated with production & services
• Further complications with service industries and enabling support services

ISIC codes linked to value chain reference model; codes in black match S-DOT (traded, potential ICT-enabled supporting industries)
**Business Functions & Organizational Decision Matrix in GVCs**

- **Business function classification**
  - 8 activities
    - 1 core + 7 supporting
    - Visual separates activities that relate to “value-adding activities”

- For any of the business functions, a company makes two choices, leading to four potential outcomes
  - Make or buy
  - Domestic or offshore

- Parenthesis indicate supplemental data sources

<table>
<thead>
<tr>
<th>Location/Organization</th>
<th>Domestic</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>Make – domestic (in-house) <em>(national surveys)</em></td>
<td>Make – offshore (FDI) <em>(AMNE)</em></td>
</tr>
<tr>
<td>External</td>
<td>Outsource – domestic <em>(I-O TBLs)</em></td>
<td>Outsource – offshore <em>(trade data)</em></td>
</tr>
</tbody>
</table>
Business Functions

• Business function surveys are asking the right questions, but usefulness depends on ability to link to other classification systems.

• Business function results need to be able to be linked to ISIC or CPC.

• As such, they will provide data on where value-adding activities take place (domestic or offshore) and how buyers set up organizational models (make or buy).

• Without links to industries, not a clear way to link data to industry-specific GVC studies.
Conclusions for GVC-ISIC comparison

• New datasets offer improvements to filling data gaps for GVC analysis
• Still need more detailed data and ability to link data *along* a chain and to other classification systems in more detail for GVC studies
• Usefulness of data will depend on ability to provide more *industry*-specific data and how business functions linked to ISIC
GVC Case Study Examples

- Governance Typologies
- Costa Rican Medical Devices
- Mexico GVC and Clusters Study (new)
- U.S. Value Chains and Jobs
Five types of global value chain governance

Source: Gereffi at al. [2005]
## Dynamics in Global Value Chain Governance

<table>
<thead>
<tr>
<th>Governance Type</th>
<th>Complexity of Transactions</th>
<th>Ability to Codify Transactions</th>
<th>Capabilities in the Supply-base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Modular</td>
<td>① High</td>
<td>② High</td>
<td>High</td>
</tr>
<tr>
<td>Relational</td>
<td>High</td>
<td>③ Low</td>
<td>⑤ High</td>
</tr>
<tr>
<td>Captive</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

① increasing complexity of transactions (harder to codify transactions; effective decrease in supplier competence)
② decreasing complexity of transactions (easier to codify transactions; effective increase in supplier competence)
③ better codification of transactions (open or de facto standards, computerization)
④ de-codification of transactions (technological change, new products, new processes)
⑤ increasing supplier competence (decreased complexity, better codification, learning)
⑥ decreasing supplier competence. (increased complexity, new technologies, new entrants)
GVCs in fresh vegetables sector (from Africa to UK)

Source: Dolan and Humphrey [2004]
COSTA RICA’S MEDICAL DEVICES GVC
Local firms are mainly in packaging & support services (12 of 19) versus 4 in limited role in plastics molding & metal finishing and 1 OEM with exports under $2 million.
Evolution of Costa Rican Medical Device Exports

- **Disposables** still the largest product category exported, but no longer a strong growth area.
- Exports in *surgical instruments* have grown steadily since 2005.
- **Therapeutics** has become 2nd largest category since 2008; likely to increase as newly established firms complete transfer of new product lines.
- Limited export of highest value *capital equipment* (eg. Electronic/software devices)
<table>
<thead>
<tr>
<th>Entry Year</th>
<th>Firm Characteristics</th>
<th>Main Product Export Category</th>
<th>Core Market Segments</th>
<th>Product Examples</th>
<th>Select Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 2000</strong></td>
<td>4 OEMs 8 Components 1 Input distributor 7 Packaging 1 Finishing 3 Support services</td>
<td>Disposables</td>
<td>Drug delivery; Women’s health</td>
<td>Intravenous tubing (I) Mastectomy bra (I)</td>
<td>Hospira; Baxter; Amoena; Corbel</td>
</tr>
<tr>
<td>24 firms: 8 US 15 CR 1 German</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2001–2004</strong></td>
<td>3 OEMs 6 Components 1 Finishing 1 Logistics provider 2 Support services</td>
<td>Instruments</td>
<td>Endoscopic surgery</td>
<td>Biopsy forceps (II)</td>
<td>Arthrocare; Boston Scientific; Oberg Industries</td>
</tr>
<tr>
<td>13 firms: 9 US 3 CR 1 Colombian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2005–2008</strong></td>
<td>2 OEM 4 Components 1 Packaging 1 Finishing</td>
<td>Therapeutics</td>
<td>Cosmetic surgery; Women’s health &amp; urology</td>
<td>Breast implants (III) Minimally invasive devices for uterine surgery (II)</td>
<td>Allergan; Tegra Medical; Specialty Coating Systems</td>
</tr>
<tr>
<td>8 firms: 7 US 1 Puerto Rico</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 firms: 16 US 1 CR 1 Ireland 1 Japan 2 Joint ventures (US-CR)</td>
<td></td>
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</tr>
</tbody>
</table>
UPGRADING SUCCESS: A LEADING MEDICAL DEVICES MNC IN COSTA RICA

- **2004**: Manufacturing functions
- **2012**: Engineering for process improvements ➔ Focused on cardiology segment; strategy – to alleviate R&D costs in the US.

- **Functional Upgrading**
  - Biopsy forceps ➔ Labor intensive, basic metal works & extrusion.
  - Urethral stent ➔ Thermoforming, laser marking, coating capabilities.
  - Today – CR facilities cover 42 manufacturing processes.

- **Product & Process Upgrading**
  - Gastroenterology segment ➔ Urology ➔ Cardiovascular

- **Market Diversification**
  - Recent co-location of sterilization vendors will allow the firm to export directly to global distribution centers

- **Exports**
  - 2004: First production plant opens in Costa Rica (10,000m²)
  - 2005: Exports: US$18 million
  - 2008: Second plant opens. (32,000m²) First plant restructuring
  - 2010: Initial plant reopens after restructuring
  - 2011: Exports: US$120 million
MEXICO STUDY ON GVCs AND CLUSTERS
Mapping of GVCs across four dimensions for each industry...

- Local clusters
- Links to other states and clusters in Mexico
- Links to United States and Canada
- Other international linkages
### Mexico’s Plan Nacional de Desarrollo, 2013-2018

**Estrategia Sectorial**

<table>
<thead>
<tr>
<th>Sectores</th>
<th>Maduros</th>
<th>Dinámicos</th>
<th>Emergentes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maduros</strong></td>
<td>• Metal mecánico</td>
<td>• Automotriz y Autoparte</td>
<td>• Biotecnología</td>
</tr>
<tr>
<td></td>
<td>• Textil-vestido y cuero-calzado</td>
<td>• Aeroespacial</td>
<td>• Farmacéutico</td>
</tr>
<tr>
<td></td>
<td>• Madera y muebles</td>
<td>• Eléctrico</td>
<td>• TI</td>
</tr>
<tr>
<td></td>
<td>• Siderúrgico</td>
<td>• Electrónico</td>
<td>• Industrias creativas</td>
</tr>
<tr>
<td></td>
<td>• Alimentos y bebidas</td>
<td>• Químico</td>
<td>• Equipo médico</td>
</tr>
<tr>
<td><strong>Impulsar la</strong></td>
<td></td>
<td><strong>Incrementar la competitividad</strong></td>
<td><strong>Atraer y fomentar los sectores emergentes</strong></td>
</tr>
<tr>
<td><strong>productividad</strong></td>
<td></td>
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</tbody>
</table>

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Pilot Study for 3 Mexican GVCs

Objectives: Design the methodology and measure upgrading and innovation (at the level of clusters, firms and jobs)

• **Mature Sector**
  – Textile-Apparel Industry

• **Dynamic Sector**
  – Aerospace Industry

• **Emergent Sector**
  – Medical Devices Industry
Automobile production in 2007 and 2011

1 USA TRADITIONAL
2 USA NEW
3 Mexico TRADITIONAL
4 Mexico NEW
5 Ontario CA
NC in the Global Economy (NCGE)

- **NCGE** is a website that provides a web-based value chain analysis of seven key industries in North Carolina
  - Tobacco, textiles & apparel, furniture, IT, biotechnology, banks & finance, hog farming,

- **Goals:** provide useful data and engaging visualizations for better decision making by policy makers, companies and educational institutions leading to more good **jobs** and **innovation**, and improved **competitiveness** in the state
Comparing NC’s employment with main US competitors

Top State Furniture Employment, by NAICS Codes: 2012

- NC: 25,231 (3371 Household), 2,844 (3372 Office), 4,989 (3379 Furniture Related)
- CA: 19,948 (3371 Household), 3,682 (3372 Office), 7,517 (3379 Furniture Related)
- TX: 13,858 (3371 Household), 3,784 (3372 Office), 6,291 (3379 Furniture Related)
- IN: 13,361 (3371 Household), 1,312 (3372 Office), 541 (3379 Furniture Related)
- MI: 14,556 (3371 Household), 4,465 (3372 Office), 1,448 (3379 Furniture Related)
- MS: 15,867 (3371 Household), 712 (3372 Office), 4,055 (3379 Furniture Related)
Comparing NC wages with main US competitors

Top Furniture State Average Annual Wages, by NAICS Code: 2012

- 3371 - Household Furniture
- 3372 - Office Furniture
- 3379 - Furniture-Related Products

<table>
<thead>
<tr>
<th>State</th>
<th>3371</th>
<th>3372</th>
<th>3379</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>37,199</td>
<td>46,298</td>
<td>38,518</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>37,595</td>
<td>36,827</td>
<td>32,659</td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>46,615</td>
<td>59,241</td>
<td>43,709</td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>30,393</td>
<td>26,266</td>
<td>33,537</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>33,070</td>
<td>35,690</td>
<td>42,508</td>
<td></td>
</tr>
<tr>
<td>TX</td>
<td>37,017</td>
<td>40,557</td>
<td>32,929</td>
<td></td>
</tr>
</tbody>
</table>
Manufacturing workers in North Carolina make, on average, nearly $8,000 less than the U.S. average.

Manufacturing Wages in North Carolina Compared to the National Average

- **North Carolina**: $44,692
- **U.S. Average**: $52,540
- **Gap**: $7,847

Sources of North Carolina’s Manufacturing Wage Gap

Broadly, there are three sources for North Carolina’s manufacturing wage gap:

1. Lower share of employment in high wage industries
2. Greater share of employment in low-wage industries
3. Lower average wage for seemingly similar industries

NC’s Potential Upgrading Strategies

**Future Growth**
- 8.4% of employment
- NC often has numerous scattered firms, but no well defined cluster

**Strengthen**
- 12.3% of employment
- Existing strengths
- High R&D
- Fill technology gaps or cross-chain upgrading

**Localized**
- 36.5% of employment
- Minimal scope for specialization or upgrading

**Transition**
- 42.9% of employment
- NC's traditional mfg. strengths
- Generally low tech
- Upgrade or mitigate decline

North Carolina’s Industry Mix

- **High Wage, Low Employment**
  - NC below Nat Employment Share
  - 3344 – Semiconductors
  - 3364 - Aerospace
  - 3231 - Printing
  - 3327 - Machine Shops

- **Low Wage, Low Employment**
  - NC below Nat Employment Share
  - 3122 - Tobacco
  - 3254 - Pharma
  - 3151 – Knit Apparel
  - 3116 – Animal Slaughtering
  - 3131 – FY&T
  - 3371 - Furniture

Policy Relevance of GVC Sector Profiles

• Closing North Carolina’s manufacturing wage gap could significantly improve wages and the standard of living in North Carolina.

• Higher productivity is the key to doing this, but also a need to improve NC’s industry mix and high wage jobs.

• Upgrading strategies are needed to define NC’s investment, employment and innovation priorities.

• Intra-U.S. comparisons are relevant, but GVC competitiveness is increasingly defined at the regional level (e.g., North America, East Asia, EU).
THANK YOU

Questions?

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