

Cracking the (Supply) Chains:

Data-Driven Strategies for Combating Modern-Day Slavery

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Binghamton University

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SAS **HACKATHON** 2023
AMERICAS REGION

End Forced Labor

Hope for Justice, US



CHAMPION

Predicting forced labor use and risks in their supply chains.

WHY SHOULD BUSINESSES TAKE ACTION?



Human Business Case



Investment



Customers



Talent Acquisition and
Retention



Legislation



Verité

Strengthening
Protections Against
Trafficking in Persons in
Federal and Corporate
Supply Chains:
Research on Risks in 34
Commodities Worldwide

U.S. Department of State

2020 Trafficking in
Persons Report

Department of Labor

2022 List of Goods
Produced by Child
Labor or Forced Labor



Risk Factors of Forced Labor in Supply Chains

How Do We Quantify the Data?

Long, complex,
non-transparent

Substantial
sourcing or
subcontracting

Labor contractors,
recruiters,
agencies and
middlemen

Tools Used to Evaluate Risk Factors



Text Conversion with Python

maneuvering, and a lack of fresh food and water. Should someone become ill while on board a vessel, it can be difficult to seek medical care in a timely manner. Collisions or shipwrecks are also a risk.³³⁷

Fishing crews are generally overseen by a captain or boss. The captain or boss has a high financial stake in a profitable voyage, incentivizing abusive management practices including actual or threatened physical abuse (hitting, threats, or actual violence with weapons, denial of rest), verbal abuse (yelling, threats), and other forms of intimidation. When setting nets or hauling in a catch, captains may be required to work around the clock without breaks for days. In some cases, captains may force workers to use amphetamines or other drugs as a way to combat fatigue.³³⁸ In extreme cases, crew members have reported witnessing murders of crew members at the hands of bosses.³³⁹

Fish and shrimp processing workers also face a high exposure to hazardous work conditions. Previous studies of the sector have identified a wide variety of risks including mechanical and electrical accidents, excessive noise levels, extreme cold, aggravation of respiratory conditions including asthma, skin and eye infections, and musculoskeletal injuries. Workers may also be exposed to 'bioaerosols containing seafood allergens, microorganisms and toxins'.¹³⁴⁰ Workers in shrimp processing facilities in Bangladesh interviewed by Verité reported being denied access to bathroom facilities for entire shifts, which can cause urinary tract infections and gastrointestinal disorders.

Vulnerable, Easily Replaced, and/or Low-Skilled Workforce: Workforce vulnerability in fishing derives from a variety of causes, some of which have to do with the typical structure of employment relationships in the industry, and some of which have to do with the economic and education levels of the worker populations in question.

On small fishing boats, employment relationships are predominantly casual.³⁴¹ Sometimes relationships between captains and crews are rooted in traditional patronage dynamics, leading to a high degree of dependence for workers, who may belong to families with historically subservient, dependent relationships to their boss's family, on whom their kin might depend for access to things like school fees or land rights, severely limiting the employee's ability to advocate for better working conditions on the fishing boat.³⁴² Further complicating employment relationships in fishing, payment on both large and small fishing vessels is often based on the traditional "share" system, in which worker pay is based on an allotment of net proceeds from the catch after expenses for output (fuel, food, etc.) are deducted. Under the "share" system, workers are considered "partners" in the fishing venture rather than employees, and therefore are not entitled to minimum wage or overtime pay.³⁴³ This arrangement also means that crew members share the risks normally associated with being owners. If a voyage does not clear a profit, workers may not be compensated, leaving them vulnerable to debt.³⁴⁴ Fishers may also have their pay docked for items consumed on board, including cigarettes, alcohol, medicine, and in some

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```
# loop through each Sect tag
for sect in soup.find_all('Sect'):

    # loop through each H4 tag within the Sect tag
    for h4 in sect.find_all('H4'):

        # get text from H4 tag
        h4_text = h4.text.strip() if h4.text else ""

        # initialize flag variable
        stop_word_encountered = False

        # loop through each P tag within the H4 tag
        for p in h4.find_next_siblings('P'):

            # exclude Link tags from P tag text
            for link in p.find_all('Link'):
                link.replace_with('')

            # check for specific stop words and start a new row in the dataframe
            if p.text.strip() in ["Economy: ", "Workforce: ", "Hazardous/Undesirable
                                   Vulnerable, Easily Replaced, and/or Low-Skilled W
                                   Migrant Workforce: ", "Presence of Labor Contract
                                   Long, Complex, and/or Non-Transparent Supply Chain"]
                # set flag variable to True to indicate stop word was encountered
                stop_word_encountered = True
                h4_list.append(h4_text)
                p_list.append("")

            else:
                # if flag variable is True, append to last element in p_list instead
                if stop_word_encountered:
                    p_text = p.text.strip().replace('\n', ' ')
                    if p_text.startswith('-'):

```

C	D	F
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Overview
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Hazardous/Undesirable Work
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Hazardous/Undesirable Work
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Hazardous/Undesirable Work
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Vulnerable, Easily Replaced, and/or Low-Skilled Workforce
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Vulnerable, Easily Replaced, and/or Low-Skilled Workforce
Fishing and Aquaculture	Risks to Human Trafficking in this Sector	Vulnerable, Easily Replaced, and/or Low-Skilled Workforce

PDF Verité Report

Import the PDF into Python for conversion

Python

BeautifulSoup library to convert XML to data

SAS Viya

Data converted using
Python ready for use in
SAS Viya Visual Text
Analytics

Table Conversion with Power BI

Cocoa is reportedly produced with forced labor (FL) and/or child labor (CL) in the following countries:	Top ten countries that produce cocoa worldwide (FAOSTAT 2014):
Cameroon (CL, FL)	1. Côte d'Ivoire
Côte d'Ivoire (CL, FL)	2. Ghana
Ghana (CL)	3. Indonesia
Guinea (CL)	4. Brazil
Nigeria (CL, FL)	5. Cameroon
Congo, Republic of the (FL)	6. Nigeria
Sierra Leone (CL)	7. Ecuador
Togo (FL)	8. Peru
	9. Dominican Republic
	10. Colombia

Verité Report

Import the PDF tables for conversion

Cocoa is reportedly produced with forced la		Top ten countries that produce	
Cameroon (CL, FL)		1. Côte d'Ivoire	
Côte d'Ivoire (CL, FL)		2. Ghana	
Ghana (CL)		3. Indonesia	
Guinea (CL)		4. Brazil	
Nigeria (CL, FL)		5. Cameroon	
Congo, Republic of the (FL)		6. Nigeria	
Sierra Leone (CL)		7. Ecuador	
Togo (FL)		8. Peru	
		9. Dominican Republic	
		10. Colombia	

Power BI

Adding structure, modifying and cleaning the data

Natural Language Processing (NLP)

Using SAS Viya Visual Text Analytics

SAS® Model Studio - Build Models

NLP Verite

Data Pipelines

Data sources

Project data table

VERITE_ALL_PARAGRAPHS

Variable Name	Type	Role
__uniqueid__	Numeric	Key
paragraph	Character	Text
topic	Character	Category
header_simple	Character	
original_h4_header	Character	
subheader	Character	
type	Character	

Filter

VERITE_ALL_PARAGRAPHS

Columns: 9

Rows: 1,018

Label: (not available)

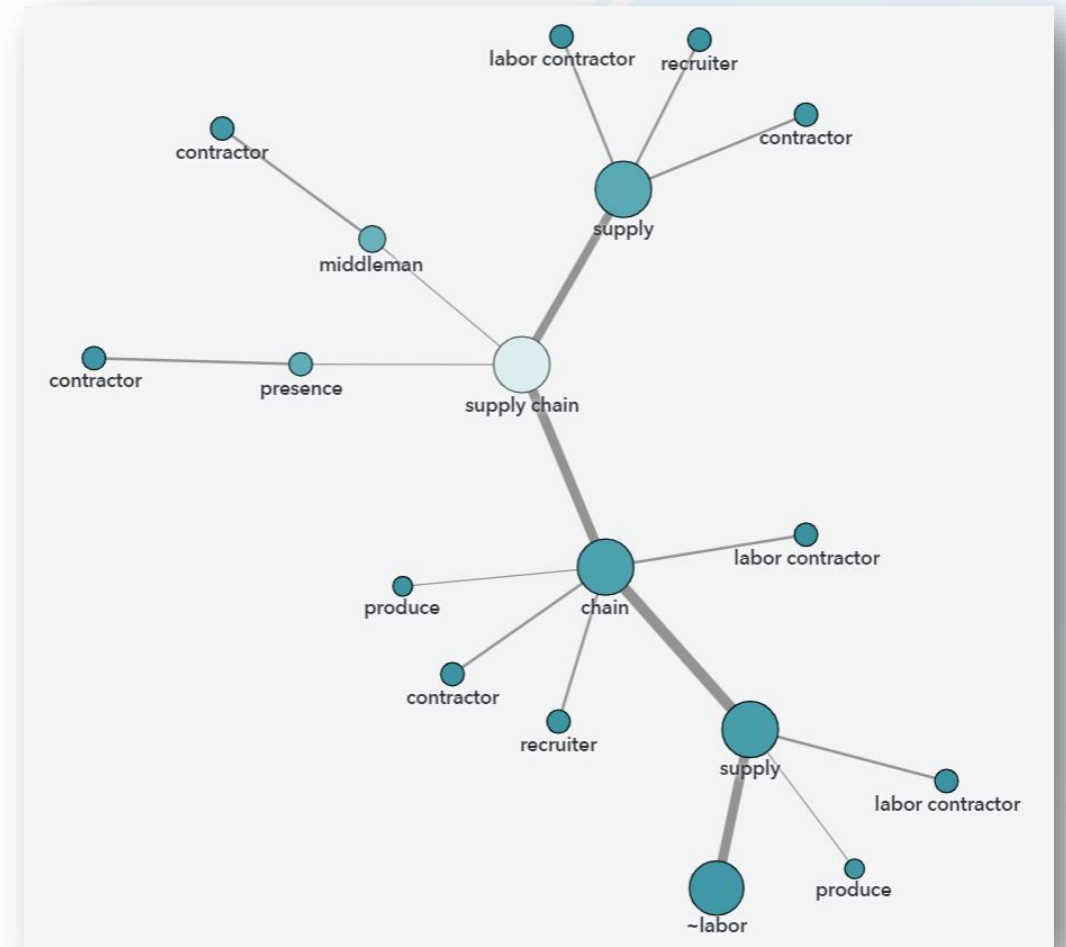
Location:



Investigating the Data

SAS Visual Text Analytics

- 1 Term Maps
- 2 Finding key terms with connectivity
- 3 Create concept rules from the findings



Concept Rules

SAS® Model Studio - Build Models

NLP Verite > Concepts

Run node Close

Concepts

Custom Concepts (11)

- c_finished_facility
- h_factory
- h_finishedproduct
- h_hierarchical
- h_labor_supplier
- h_obscure
- h_sc_auto
- h_sc_general**

Textual Elements (2270)

Filter

String	Role	Freque...
worker	N	1076
labor	N	697
child	N	657
work	V	449
sector	N	363
also	ADV	318
country	N	308
percent	N	301
state	N	293
production	N	271

Edit Concept Sandbox

h_sc_general

```
1 CONCEPT_RULE:(OR,"_c{manufacturers}","_c{manufacturer}")
2 CONCEPT_RULE:(OR,"_c{third party}")
3 CONCEPT_RULE:(OR,"_c{third-party}")
4 CONCEPT_RULE:(OR,"_c{agents}","_c{agent}")
5 CONCEPT_RULE:(OR,"_c{middlemen}","_c{middleman}")
6 CONCEPT_RULE:(OR,"_c{sub-contracting}","_c{sub-contracted}","_c{sub-contract}")
7 CONCEPT_RULE:(OR,"_c{subcontractors}")
8 CONCEPT_RULE:(OR,"_c{subcontracted}","_c{subcontracting}","_c{subcontract}")
9 CONCEPT_RULE:(OR,"_c{outsourcing}","_c{outsourced}","_c{outsource}")
10 CONCEPT_RULE:(OR,"_c{outsourced}")
11 CONCEPT_RULE:(OR,"_c{brokers}","_c{broker}")
```

Code is valid

Documents Test Sample Text

All (1018) Matched (229 of 1018) Search

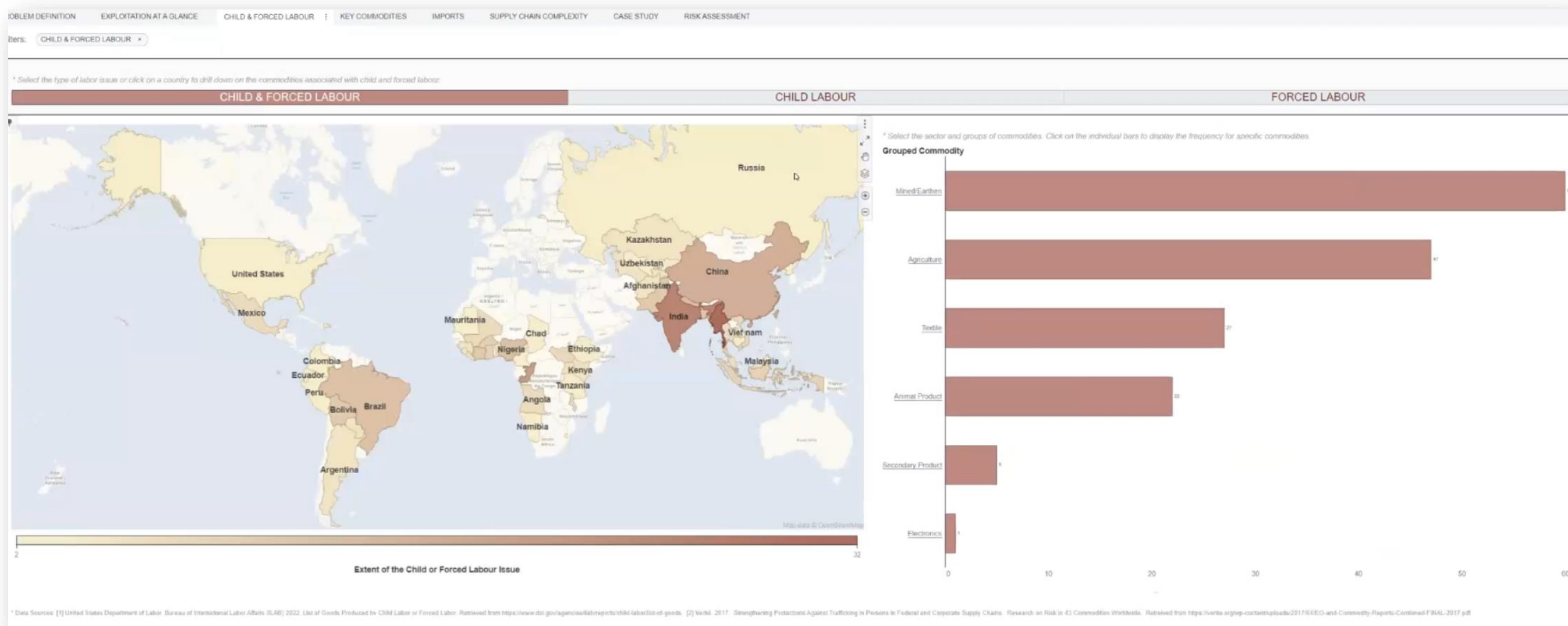
paragraph	Fact Mat...	header...	subheader	topic	type
...the fifty large companies accounting for about thirty percent of the revenue, according to one industry analysis. Smaller companies and self-employed cleaners tend to service residential properties, while larger companies generally provide cleaning services to businesses and institutions.	0	Overview	Economy	Housekeeping/Facilities	Industry Sector
...multiple levels of middlemen can be so intricate and opaque as to more closely resemble a web. Fish and shellfish are harvested in open waters or raised via aquaculture in ponds, tanks, or bounded coastal waters. Some wild-caught fish may be transported from the catching vessel by transshipment...	0	Production and Supply Chain		Fish	Commodities
...sector is increasing subcontractors . The mechanisms of broker-induced labor trafficking vary depending on countries and contexts. In the Indian sugar sector, migrant workers in the state of Tamil Nadu are recruited by brokers who provide advances for transportation and living expenses, to...	0	Risks	Presence of Labor Contractor	Agriculture	Industry Sector
...have their own subcontractors while others are individuals operating independently. Some labor contractors...	0	Risks	Presence of Labor Contractor	Agriculture	Industry

Document 7 of 229

Highlight: Concept matches Search matches

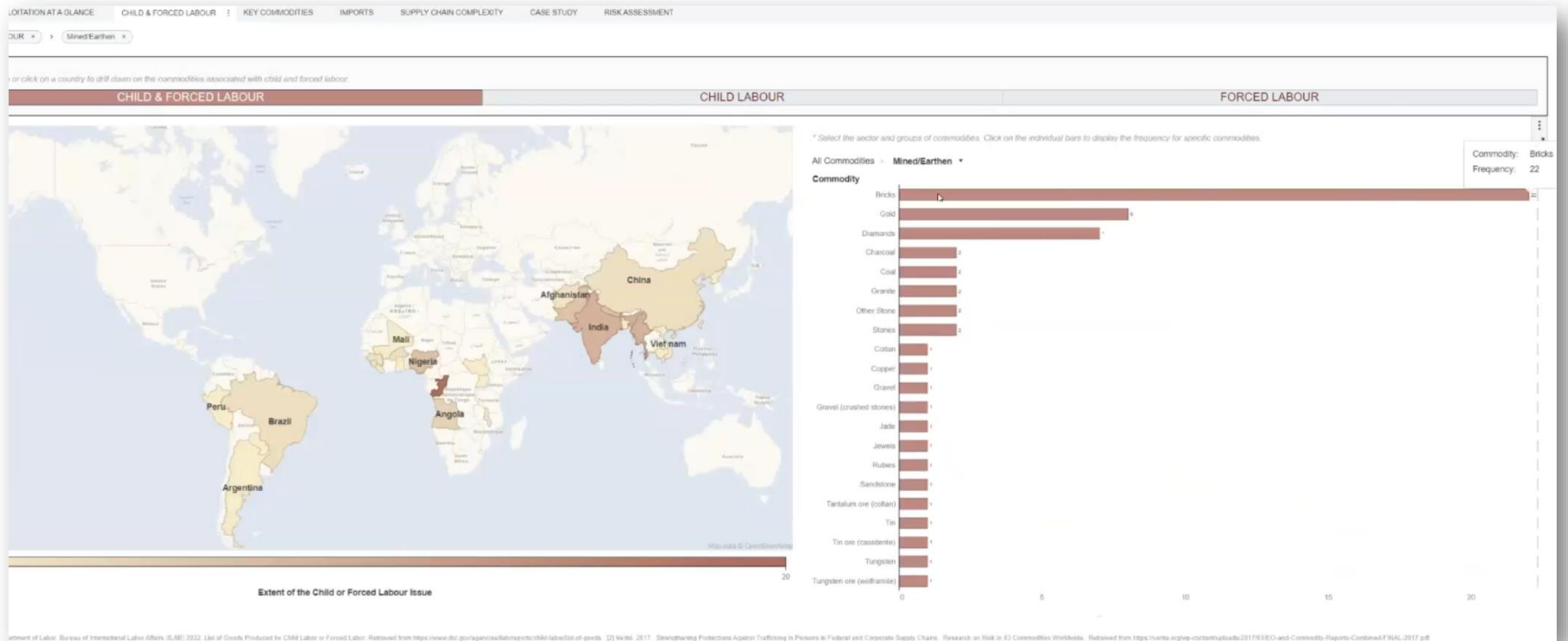
Child and Forced Labor Prevalence

By Country and Commodity



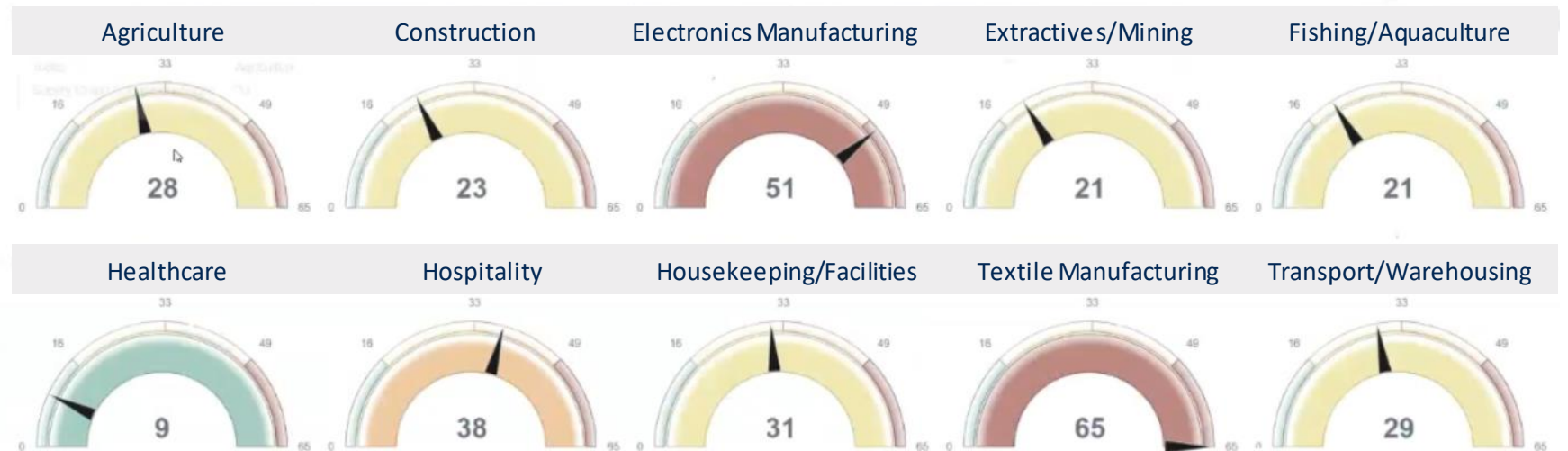
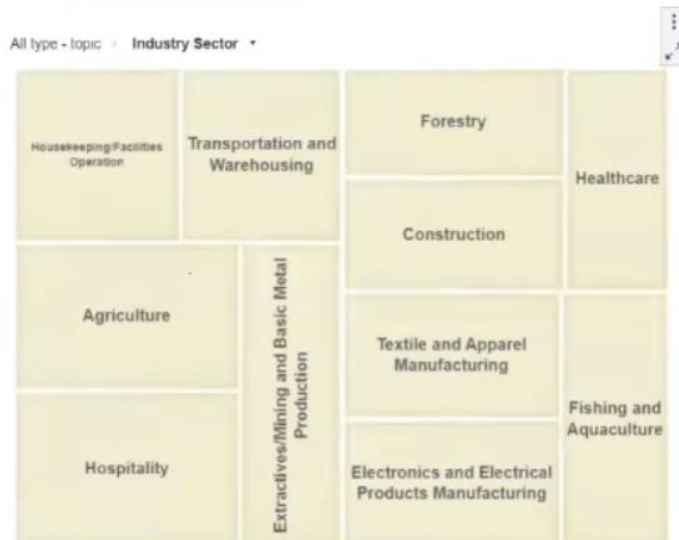
Child and Forced Labor Prevalence

By Country and Commodity



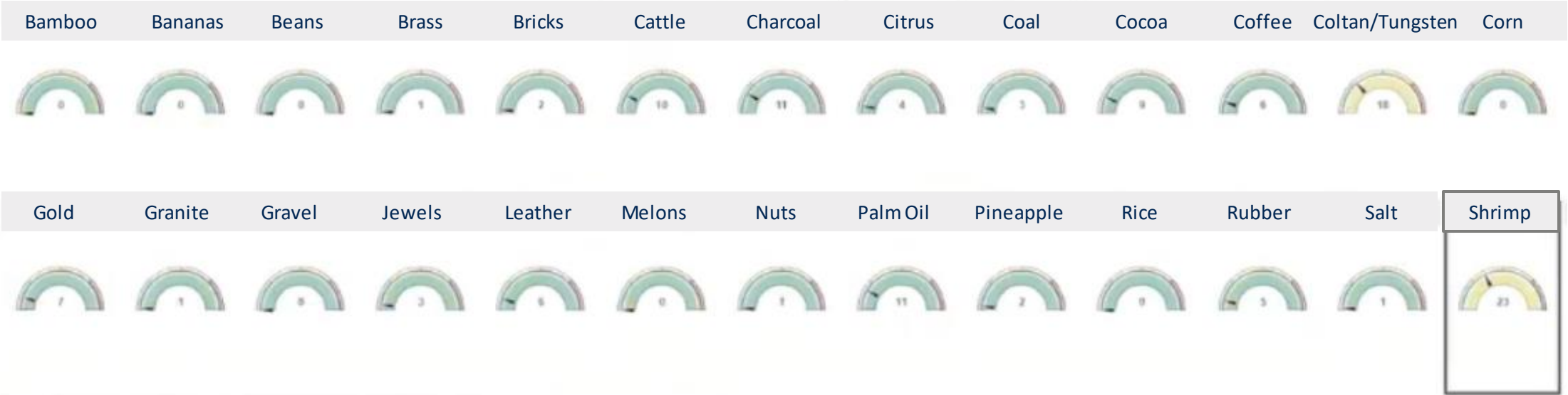
Supply Chain Complexity - Industry

facilitate broker(s)
subcontractors outsource
multi-national companies middlemen
agent(s) manufacturers
third-party
companies
suppliers retailer(s)
sub-contracting



Supply Chain Complexity - Commodities

broker(s)
facilitate
subcontractors
multi-national companies
agent(s)
third-party
middlemen
outsources
manufacturers
companies
suppliers
sub-contracting
retailer(s)



Topic	Match Text	Paragraph
Shrimp	middlemen	Children are involved in wild fry (larvae) collection in Bangladesh, and are exposed to extreme temperatures and illness from long periods of time standing in water. Fry collectors are also vulnerable to cycles of debt as they take...
Shrimp	suppliers	Concern centered on health and safety in global shrimp suppliers has driven demand for increased visibility in shrimp supply chains. Several groups have developed voluntary, third-party certification schemes for shrimp includin...
Shrimp	middlemen	Farming shrimp requires the collection of shrimp fry. Fry can either be caught in coastal waters or ponds (more common in Bangladesh), or produced in hatcheries (more common in Thailand). Fry from wild collection or hatcheri...
Shrimp	middlemen	Research on Indicators of Forced Labor in the Supply Chain of Shrimp in Bangladesh. Verite performed research in the Bangladesh shrimp industry and found indicators of forced labor in the three major stages of shrimp product...
Shrimp	middlemen	U.S. and U.K. retailers also created a task force and teamed up with Thai shrimp producers to address weaknesses in the shrimp supply chain management in coastal of Thailand's highest shrimp production and export coastal...

HOW CAN BUSINESSES CARRY OUT DUE DILIGENCE AND MINIMIZE THE RISK OF MODERN-DAY SLAVERY?

Source: <https://www.nytimes.com/topic/subject/forced-labor> and <https://www.bonappetit.com/story/gt-kombucha-worker-exploitation>

MAR 2023

In World Cup Run-Up, Qatar Pressed U.N. Agency Not to Investigate Abuses

Lobbying at the International Labor Organization dovetailed with an influence campaign that set off a corruption scandal at the European Parliament.

By REBECCA R. RUIZ and SARAH HURTES

JUN 2023

Founder of Sexual Wellness Company Indicted on Forced Labor Charges

Prosecutors say that Nicole Daedone, who founded OneTaste on promises of nurturing women's sexuality, abused her followers and lived off them.

By HURUBIE MEKO

AUG 2023

Workers Say GT's Kombucha Is Made with 100% Pure Exploitation

A new court ruling finds intimidation, unpaid overtime, and other allegations of abuse at GT's kombucha factories, according to the *Los Angeles Times*.

JUN 2023

Addicts Went in for Treatment. Instead They Were Enslaved.

Families in Indonesia thought they were sending their sons to a rehab facility run by a powerful local official. Those who stayed there say it was a brutal human slavery operation.

By RICHARD C. PADDOCK

JUN 2023

Shein Flew Influencers to China to Help Its Image. A Backlash Ensued.

The fast-fashion company's attempt to rebut allegations of forced labor and poor working conditions was met with incredulity online.

By JORDYN HOLMAN and SAPNA MAHESHWARI

JUL 2021

Blinken Says Coronavirus Restrictions Increased the Risk of Human Trafficking

The State Department released a report which assessed cases of reported human trafficking and exploitation between April 2020 and March 2021. Secretary of State Antony J. Blinken warned that some countries were not doing enough to stop human trafficking.

By THE ASSOCIATED PRESS

DEC 2022

Global Car Supply Chains Entangled With Abuses in Xinjiang, Report Says

A new report on the auto industry cites extensive links to Xinjiang, where the U.S. government now presumes goods are made with forced labor.

By ANA SWANSON

Place a critical eye on supply chain partners, distribution carriers, and labor practices

RISK ASSESSMENT TOOL

What can businesses do to eradicate the risk of labor exploitation in their supply chains?

Complete this abridged questionnaire to gauge a risk score for your business. Follow the link at the bottom of this page for the full version.

EXPLOITATION AT A GLANCE

CHILD & FORCED LABOUR

KEY COMMODITIES

IMPORTS

SUPPLY CHAIN COMPLEXITY

CASE STUDY

RISK ASSESSMENT

> +

Q1: How would you describe your understanding of your supply chain?

Select Your Response

Recommendation(s)

Conduct supply chain mapping exercise

Q3: Which of the following agreements do you have with your suppliers?

Select Your Response

Recommendation(s)

Meet with supplier and create additional agreements

Q5: Are the workers in the supplier's facilities or operations working conditions acceptable??

Select Your Response

Recommendation(s)

Request evidence of compliance with legislation
Request immediate rectification of issues

Q2: How often do you conduct supplier profiling?

Select Your Response

Recommendation(s)

Conduct supplier profiling exercise
Consider increasing frequency

Q4: What is your understanding of your supplier workforce?

Select Your Response

Total Risk Score

0

Max Risk Score for Q1-6 = 27

GOOD

[Risk Score = 0]

We have conducted a supply chain mapping exercise and can account for all the businesses involved in our entire supply chain and the countries in which they operate.

AVERAGE

[Risk Score = 2]

We have some understanding of the origins of the products or commodities in our supply chain. However, not beyond the second or third tier.

POOR

[Risk Score = 5]

We have little knowledge of where our products derive from or the countries in which they are produced.



Click here for the full questionnaire



NOTE: The question prompts and recommendations were co-developed with the assistance of subject matter experts, Marc Stanton and Tom Frost of Slave-Free Alliance and Hope for Justice

Dynamic Filter

Drop-Down List Control + List Table

Q1: How would you describe your understanding of your supply chain?

Select Your Response

Recommendation(s)

Conduct supply chain mapping exercise

Q2: How often do you conduct supplier profiling?

Select Your Response

Recommendation(s)

Conduct supplier profiling exercise

Consider increasing frequency

Increase frequency

Total Risk Score

0

Max Risk Score for Q1-6 = 27

Parameters

Edit Parameter

Name:

RiskScoreQ1

The parameter is used by the control Slider - RISK_SCORE Q1.

Type:

Numeric

☐ Multiple values

Minimum value:

0

Maximum value:

5

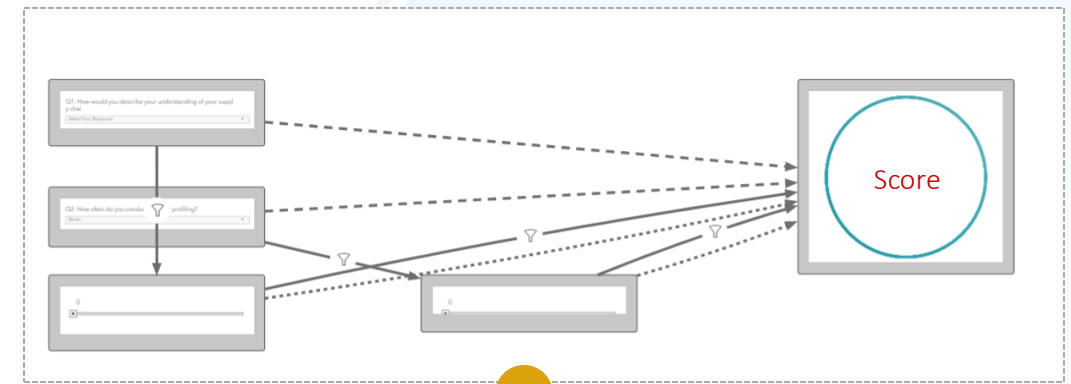
Format:

COMMA12. (Comma)

Default:

0

Slider Control



6

Edit Calculated Item

Name: Total Risk Score

Result Type: @ Aggregated Measure

Format: COMMA12.2 (Comma)

Base expression

Data Items Operators

Search

Sum [_ByGroup_] (('RiskScoreQ1'p + 'RiskScoreQ2'p + 'RiskScoreQ3'p + 'RiskScoreQ4'p + 'RiskScoreQ5'p + 'RiskScoreQ6'p))

Beyond Forced Labor in the Supply Chain

Using a wider lens to explore the depth and breadth of modern-day slavery

Arab States
10.1 per thousand

Europe & Central Asia
6.9 per thousand

Asia & the Pacific
6.8 per thousand

Africa
5.2 per thousand

The Americas
5.0 per thousand

The total magnitude of modern-day slavery – comprising of both forced labor and forced marriage – is difficult to assess. Data constraints and incomplete reporting compound a true measure of scale

Many victims are part of a hidden population

Actual estimates could be up to **49.6 million**

BREAKING THE CYCLE

DETECTION

AWARENESS

PREVENTION

We believe that it is possible to be more proactive rather than reactive to this global humanitarian issue.



**SLAVE-FREE
ALLIANCE**

Working Towards a
Slave-free Supply Chain



HOPE FOR JUSTICE

Image: iStock

SAS EXPLORE

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sas

THANK YOU!

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Special thanks to:



SLAVE-FREE
ALLIANCE

Working Towards a
Slave-free Supply Chain



HOPE FOR JUSTICE

Tom Frost
Tom Sabo
Marc Stanton
John Stultz

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Predicting forced labor use and risks in their supply chains.