



# LIBERIA CASE STUDY

RESOURCE SECTOR OVERVIEW AND VALUE CHAIN ANALYSIS

DECEMBER 2012

# UNDERSTANDING LIBERIA'S RESOURCE SECTOR OBJECTIVES AND PROCESS

## 1. Market Size

- Identify primary mineral, agricultural, human capital and other natural resources within Liberia and West African region
- Quantify using bottom up data collection and top down estimation
- Define primary and secondary value chain structure

## 2. Opportunity Analysis

- Rank potential development, extraction and growth opportunities within target resource sectors
- Estimate infrastructure, linkages or baseline conditions required to initiate growth or development goals

## 3. Growth Projections

- Identify, highest potential growth opportunities within each resource sector
- Define growth assumptions and methodologies for estimation
- Benchmark against regional / Africa opportunity set

# METHODOLOGY

## Renewable

Agriculture

Timber

1. Define baseline harvest yields + land under cultivation
2. Sort agricultural outputs by economic impact, price and production quantity for domestic and export purposes.
3. Introduce productivity, agriculture footprint and crop rotation assumptions into model
4. Run growth and scenario analysis

## Extractive

Mining

Oil and Gas

1. Define in-place resource reserves from secondary data and research reports
2. Define regional market boundaries
3. Define extraction rate thresholds
4. Research pricing projections
5. Estimate infrastructure requirements and projected extraction rates
6. Project market revenue and growth

# AGRICULTURE MARKET SIZING

## LIBERIA & WEST AFRICA ESTIMATES: 2010

Agriculture Market Sizing	Units	Liberia	West Africa	West Africa Subregion
Total Land Area	Ha	9,736,842	511,091,400	353,858,000
Potential Agricultural Land	Ha	3,700,000	236,000,000	70,521,000
Cultivated Cropland	Ha	563,080	94,568,471	19,789,224
Agricultural Output (Total)	Tonnes	1,725,190	244,944,188	31,708,477
Agricultural Output (Domestic)	Tonnes	1,644,738	237,958,471	31,045,698
Agricultural Output (Export)	Tonnes	104,145	6,985,717	662,779
Domestic Market Value	USD	\$588,856,400	\$89,623,837,898	\$10,247,888,512
Export Market Value	USD	\$197,774,000	\$10,247,641,000	\$836,188,000
<b>Total Estimated Market Value</b>	<b>USD</b>	<b>\$786,630,400</b>	<b>\$99,871,478,898</b>	<b>\$11,084,076,512</b>

Source: Worldbank and FAO

# AGRICULTURAL OUTPUT

## BOTTOM-UP GROWTH PROJECTIONS: 2012 - 2030

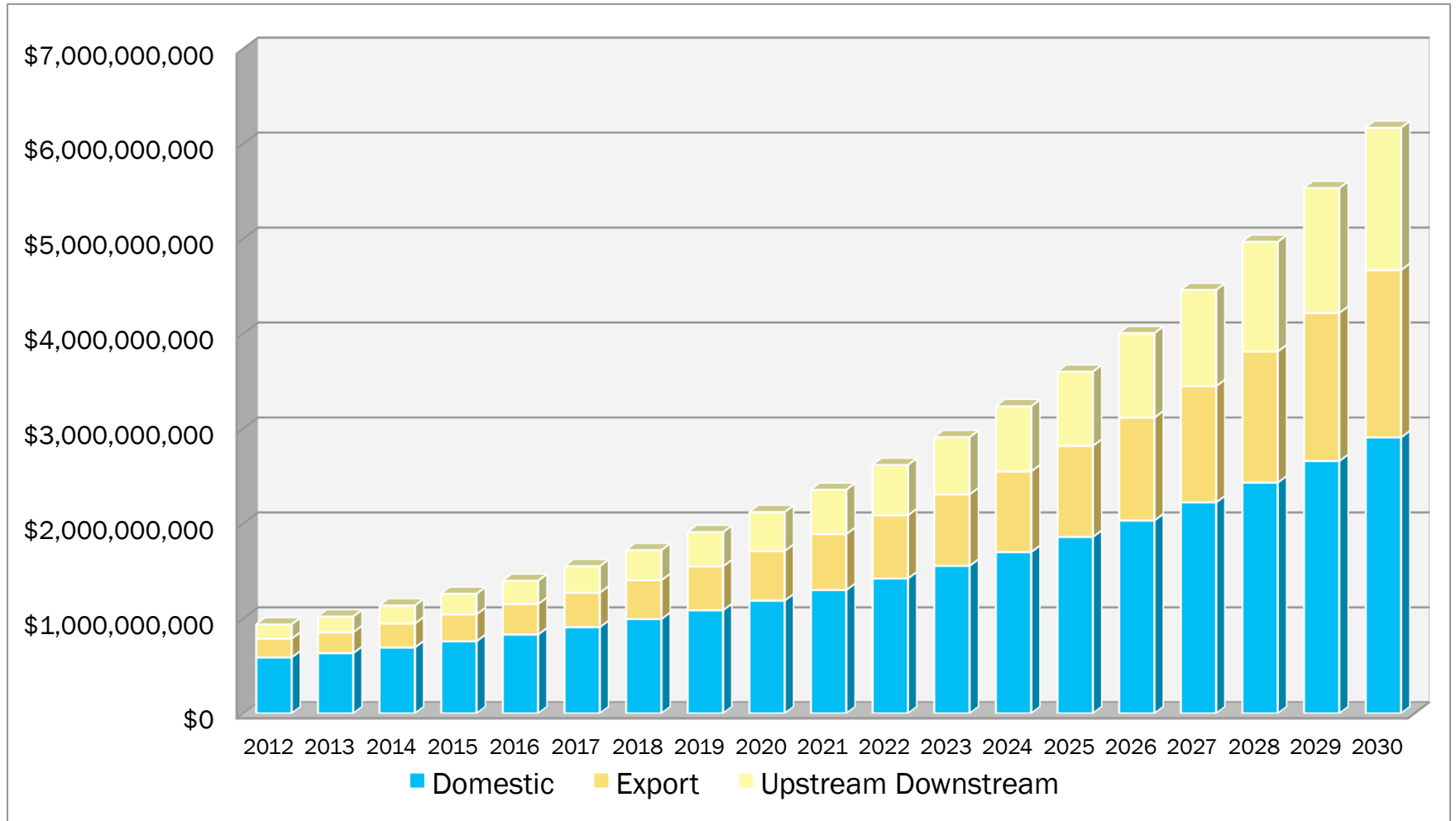
### LIBERIA

Cumulative Value (Domestic Market Output)	\$27,170,844,791
Domestic Output 2030 est.	\$2,906,617,585
Cumulative Value (Export Market Output)	\$13,666,867,608
Export Output 2030 est.	\$1,761,888,367
Cumulative Value (Total Midstream Market)	\$40,837,712,399
Total Midstream Output 2030 est.	\$4,668,505,952
Cumulative Value (Upstream & Downstream Value Chain)	\$11,278,980,430
Up/Down Value Chain Output 2030 est.	\$1,499,938,130
Cumulative Market Value	\$52,116,692,829
<b>Total Agricultural Value Chain Output 2030 est.</b>	<b>\$6,168,444,082</b>

\*BOTTOM UP ANALYSIS AND PROJECTION OF EXPORT + DOMESTIC MARKET

# LIBERIA AGRICULTURE OUTPUTS

## GROWTH PROJECTIONS: 2012 - 2030



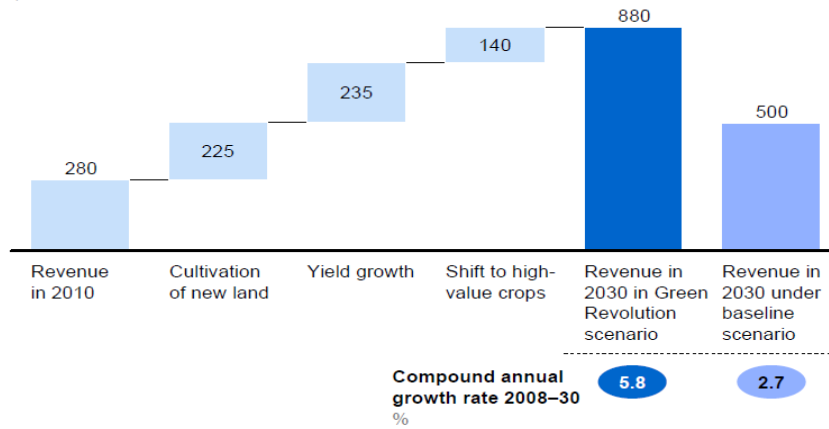
# ALTERNATIVE GROWTH MODEL BASED ON MCKINSEY *LIONS* METHODOLOGY

McKinsey Growth Estimates 2030	Liberia Subregion	Liberia
Base Growth	\$18,519,673,213	\$1,293,444,567
Additional Land	\$10,000,000,000	\$698,416,517
Yield Gains	\$24,000,000,000	\$1,676,199,642
Higher value crops	\$12,000,000,000	\$838,099,821
Green Revolution Gains	\$46,000,000,000	\$3,212,715,980
<b>2030 Annual Revenue Projections</b>	<b>\$64,519,673,213</b>	<b>\$4,506,160,546</b>
Total Annualized Growth		6%

Liberia Estimates under this model derived from McKinsey Green Revolution growth assumptions for Africa at large (see below)

## An African “green revolution” could raise agricultural production to \$880 billion per annum by 2030

Africa agricultural production revenue  
\$ billion



# SELECTED AGRICULTURAL OPPORTUNITY SECTOR

## PALM OIL

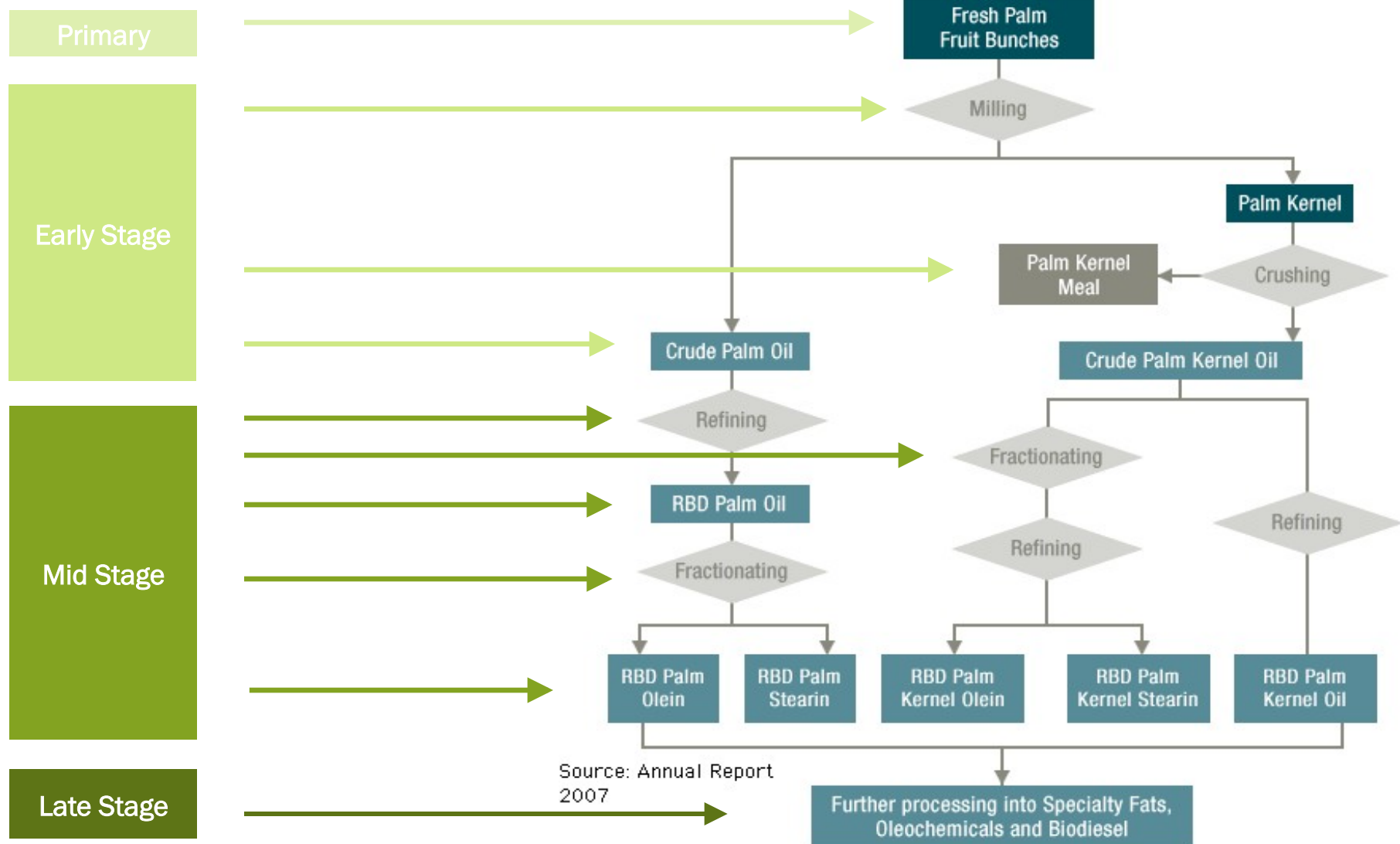
Rank	Area	Item	Unit (000's)	2008	2009	2010
1	Western Africa	Cocoa beans	\$	3,507,865	4,607,819	4,239,990
3	Western Africa	Rubber Nat Dry	\$	672,747	514,064	1,001,251
4	Western Africa	Cocoa Paste	\$	445,009	489,026	610,368
2	Western Africa	Cotton lint	\$	716,728	553,543	591,701
<b>6</b>	<b>Western Africa</b>	<b>Palm oil</b>	<b>\$</b>	<b>409,961</b>	<b>397,413</b>	<b>450,131</b>
5	Western Africa	Cocoa Butter	\$	380,176	430,524	433,307
7	Western Africa	Cashew nuts, with shell	\$	422,208	324,891	298,499
8	Western Africa	Coffee, green	\$	164,603	153,240	203,527

Liberia Palm Oil Potential	Unit	Value
Average Oil Palm Productivity	Tonnes / Ha	7.54
Palm Oil Land Under Cultivation Addition	Ha / Year	10,000
Liberia Oil Current Palm Oil Land	Ha	17,000
<b>Current potential export \$ / year</b>	<b>\$</b>	<b>\$15,640,000</b>
<b>2030 potential export \$ / year</b>	<b>\$</b>	<b>\$205,120,000</b>



# Downstream Opportunities

# Palm Oil Value Chain



# LIBERIA TIMBER MARKET OVERVIEW

<b>Liberia Total Timber Market – Commodity Based</b>	<b>Units</b>	<b>Value</b>
Total Liberia timber region*	Ha	4,300,000
Granted timber concessions	Ha	2,400,000
Non-concession timber region	Ha	1,900,000
Sustainable timber extraction ratio**	m3/Ha	0.22
Total sustainable timber extraction potential (per annum)	m3	946,000
Sawn timber price / m3	\$usd	\$152
<b>Total annual extractable timber (commodity value)</b>	<b>\$ usd</b>	<b>\$143,792,000</b>

\* LIBERIA INVESTMENT OFFICE

\*\*GROWING FOREST PARTNERS ANALYSIS

## Liberia Current Estimated Timber Extraction

<b>Current timber harvest value*</b>	<b>\$ usd</b>	<b>\$80,256,000</b>
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BASED ON CURRENT ALLOCATED TIMBER CONCESSIONS OF 2.4MM HA. AT SAWN TIMBER PRICE

## Value Add Scenario

Ghana value added plywood market price	\$ usd	\$381
Conversion to value added goods (15% total market)	m3	141,900
Market estimate w 15% value-added Eports		\$54,063,900
<b>Combined timber and value added products market</b>	<b>\$ usd</b>	<b>\$176,287,100</b>

BASED ON FAO AND WORLDBANK DATA 2010

# LIBERIA & WEST AFRICA OIL MARKET SIZING

Oil & Gas Market Sizing	Units	Liberia	West Africa Coast <sup>4</sup> <i>(includes Liberia)</i>	Gulf of Guinea <sup>5</sup>	Total Region
Undiscovered Recoverable Oil <sup>1</sup>	Billion bls	1	3.2	4.07	7.27
Market Value ( Nov 12 Brent)	USD	\$110.00 bn	\$ 352.00 bn	\$454.22 bn	\$813.65 bn
Production (in 2017)	Bls per day	100,000	100,000	134,000	234,000
Ann. Growth Rate of Production <sup>2</sup>		3.5%	3.5%	3.5%	7%
Export Value in 2017	USD	\$3.6 bn	\$3.6 bn	\$4.84 bn	\$8.45 bn
Export Value in 2030 <sup>3</sup>	USD	5.65 bn	\$5.65 bn	\$7.57 bn	\$13.22 bn

**Source: USGS surveys 2010, 2011**

<sup>1</sup> United States Geological Survey mean estimates of undiscovered, technically recoverable oil

<sup>2</sup> Based on Average Growth Rate of Nigeria Oil Production of last 20 years

<sup>3</sup> Assumes no price inflation or oil price volatility

<sup>4</sup> Liberia, Sierra Leone, Guinea

<sup>5</sup> Cote D'Ivoire, Ghana, Benin

# LIBERIA OIL & GAS VALUE CHAIN

NAICS	Name	Per 1 Billion BOE	% of Total Rev.	Prod. Growth Rate %	In 2030
<b>UPSTREAM</b>			<b>30%</b>		
2111	O&G Extraction	\$38	75%	3.5%	\$2,172,615,079
213111	Drilling O&G	\$3	6%	3.5%	\$187,441,301
213112	Support Activities for O&G	\$7	14%	3.5%	\$391,922,720
333132	O&G Equipment	\$3	5%	3.5%	\$144,841,005
	<b>SUBTOTAL</b>	<b>\$51</b>			<b>\$2,896,820,106</b>
<b>MIDSTREAM</b>			<b>4%</b>		
237120	O&G Pipeline construction	\$4	64%	3.5%	\$255,601,774
4862	Pipeline transport of nat. gas	\$3	36%	3.5%	\$144,841,005
	<b>SUBTOTAL</b>	<b>\$7</b>		<b>3.5%</b>	<b>\$400,442,779</b>
<b>DOWNSTREAM</b>			<b>66%</b>		
32411	Petroleum refineries	\$87	76%	3.5%	\$4,941,634,298
32511	Petrochemicals	\$12	10%	3.5%	\$664,564,613
3252	Polymers	\$15	13%	3.5%	\$860,525,973
	<b>TOTAL</b>	<b>\$113</b>			<b>\$6,466,724,883</b>

Value Chain estimates compiled from 2007 US Census of Business; scaled to 1Billion bbls of oil in Liberia

Retrieved from <http://www.alleghenyconference.org/PDFs/PRAMisc/TamericaRptOilGasSupplyChain071811.pdf>

# LIBERIA & REGIONAL OIL MARKET & VALUE CHAIN GROWTH PROJECTIONS\*

## Liberia

Cumulative Export Market thru 2030	\$63,875,790,198
Export Output in 2030 est.	\$5,651,355,224
Cumulative Upstream Value Chain thru 2030	\$32,742,000,101
Upstream Value Chain in 2030 est.	\$2,896,820,106
Cumulative Downstream Value Chain thru 2030	\$73,091,700,227
Downstream Value Chain in 2030 est.	\$6,466,724,883

## Regional

Cumulative Export Market thru 2030	\$149,469,349,063
Export Output in 2030 est.	\$13,224,171,224
Cumulative Upstream Value Chain thru 2030	\$76,616,280,238
Upstream Value Chain in 2030 est.	\$6,778,559,048
Cumulative Downstream Value Chain thru 2030	\$171,034,578,530
Downstream Value Chain in 2030 est.	\$15,132,136,227

\*BASED ON COMBINING MARKET SIZING PROJECTIONS WITH VALUE CHAIN STUDY

# LIBERIA & REGIONAL MINING SECTOR MARKET SIZING

Mining Sector Market Sizing	Units	Liberia	Guinea	Sierra Leone	Cote d'Ivoire	Total Region
Market value of in situ reserves <sup>1</sup> (2012 prices) <sup>2</sup>						
Bauxite	USD millions	-	24,357	11,235	-	<b>35,592</b>
Iron Ore	USD millions	37,167	381,454	450,075	26,117	<b>894,814</b>
Gold	USD millions	2,605	3,165	76	14,238	<b>20,085</b>
Diamonds	USD millions	-	170	1,787	141	<b>2,098</b>
Rutile	USD millions	-	-	11,263	-	<b>11,263</b>
<b>Total</b>	USD millions	<b>39,772</b>	<b>409,146</b>	<b>463,174</b>	<b>40,497</b>	<b>952,589</b>
<b>Export Value in 2011<sup>3</sup></b>	USD millions	<b>40</b>	<b>828</b>	<b>587</b>	<b>253</b>	<b>1,707</b>
<b>Export Value in 2030<sup>4</sup></b>	USD millions	<b>3,440</b>	<b>13,549</b>	<b>6,447</b>	<b>1,314</b>	<b>24,750</b>

Sources: USGS survey 2010, International Trade Centre

<sup>1</sup> United States Geological Survey mean estimates of measured, indicated, and in most cases inferred mineral resources

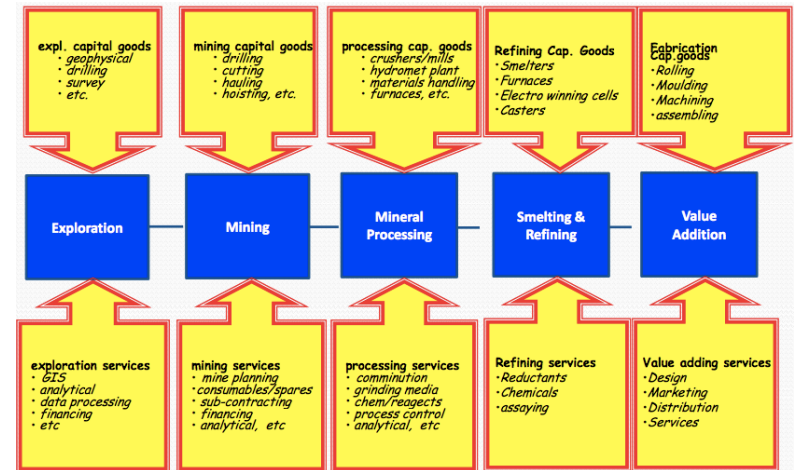
<sup>2</sup> Iron ore 2030 price assumption is \$69.20, based on the mean of long term broker projections. All other prices assume no price inflation or price volatility

<sup>3</sup> Includes export classifications 26, 71, and 72: Ores, slag, ash; Pearls, precious stones, metals, coins, etc.; and Iron & steel

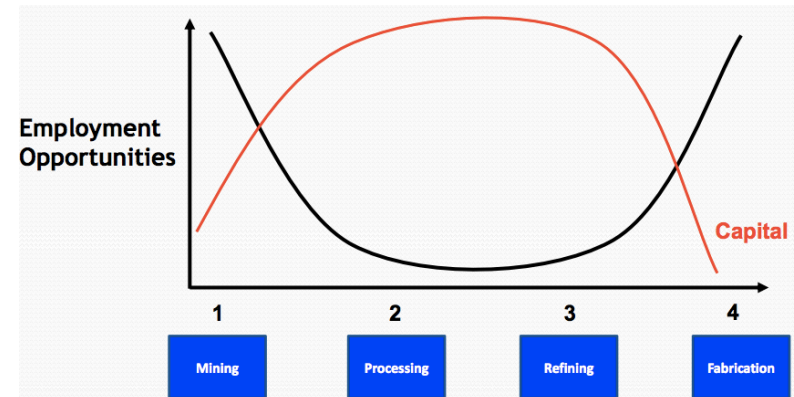
<sup>4</sup> Assumes production level targets of those facilities scheduled to be in operation in 2030, as reported by the United States Geological Survey

# LIBERIA MINING SECTOR VALUE CHAIN

Mineral Production Value Chain			
	% of total cost	Value in 2011	Value in 2030
		USD millions	USD millions
<b>Mining</b>			
Load & haul	26.7%	11	1,505
Drilling	3.7%	1	206
Blasting	4.4%	2	249
Management and technical services	4.9%	2	279
Other costs	17.5%	7	989
<b>Processing</b>			
Crushing	3.8%	2	212
Grinding	19.7%	8	1,109
Recovery	9.7%	4	546
Laboratory	2.1%	1	118
Other	7.2%	3	406
<b>Total</b>		<b>40</b>	<b>5,619</b>



Source: Diversifying a Mineral Based Economy, EcoPartners



Source: Diversifying a Mineral Based Economy, EcoPartners

Value Chain estimates compiled from USGS survey 2010 and Achieving High Performance in Mining, Accenture

Retrieved from [http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture\\_Mining\\_brochure.pdf](http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_Mining_brochure.pdf)

# LIBERIA & REGIONAL MINING SECTOR VALUE CHAIN GROWTH PROJECTIONS\*

## Liberia

Export Output in 2030 est. \$3,440,000,000

Upstream Value Chain in 2030 est. \$3,228,000,000

Downstream Value Chain in 2030 est. \$2,391,000,000

## Regional

Export Output in 2030 est. \$24,749,000,000

Upstream Value Chain in 2030 est. \$14,157,000,000

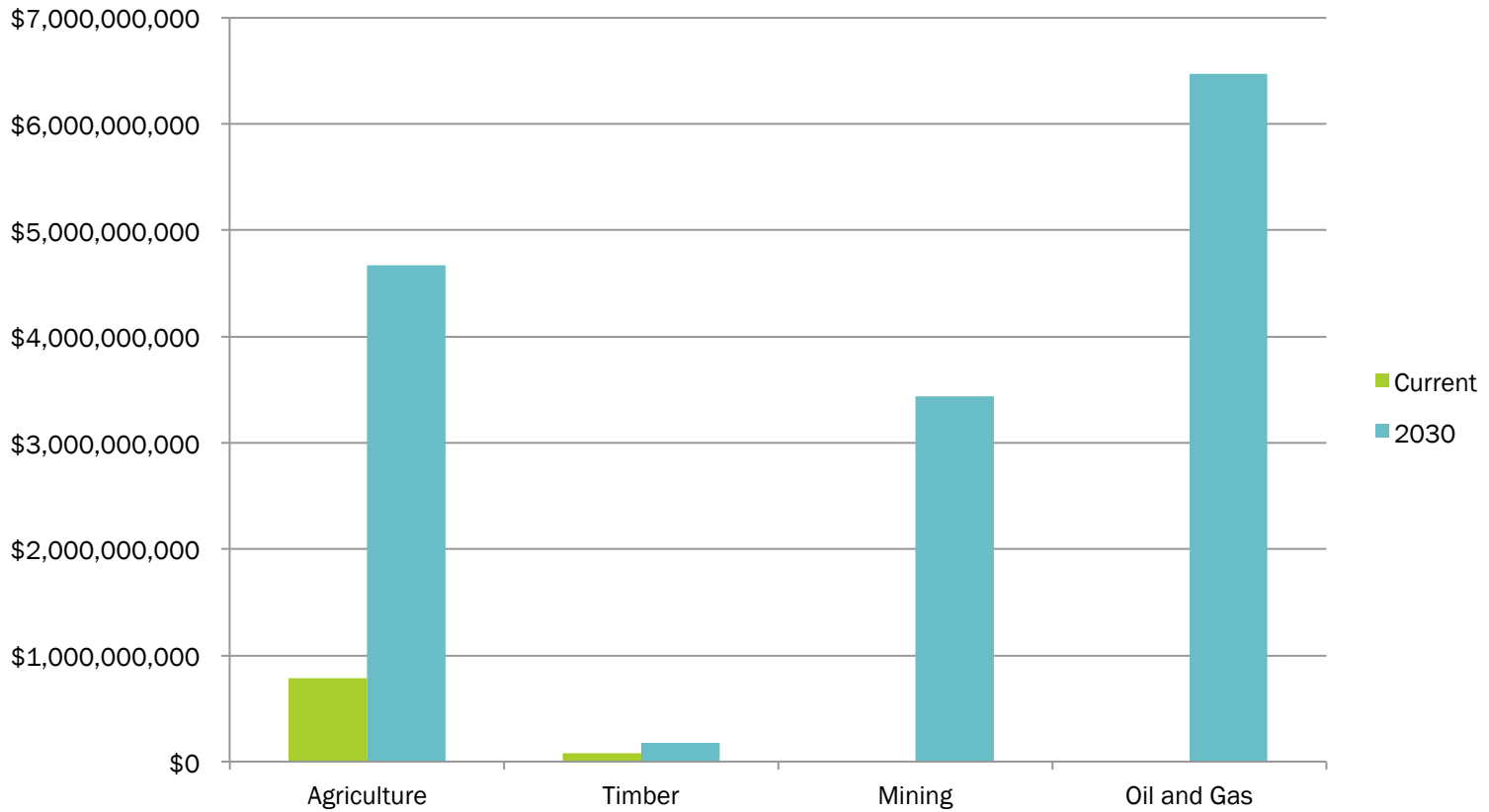
Downstream Value Chain in 2030 est. \$15,824,000,000

\*BASED ON COMBINING MARKET SIZING PROJECTIONS WITH VALUE CHAIN STUDY



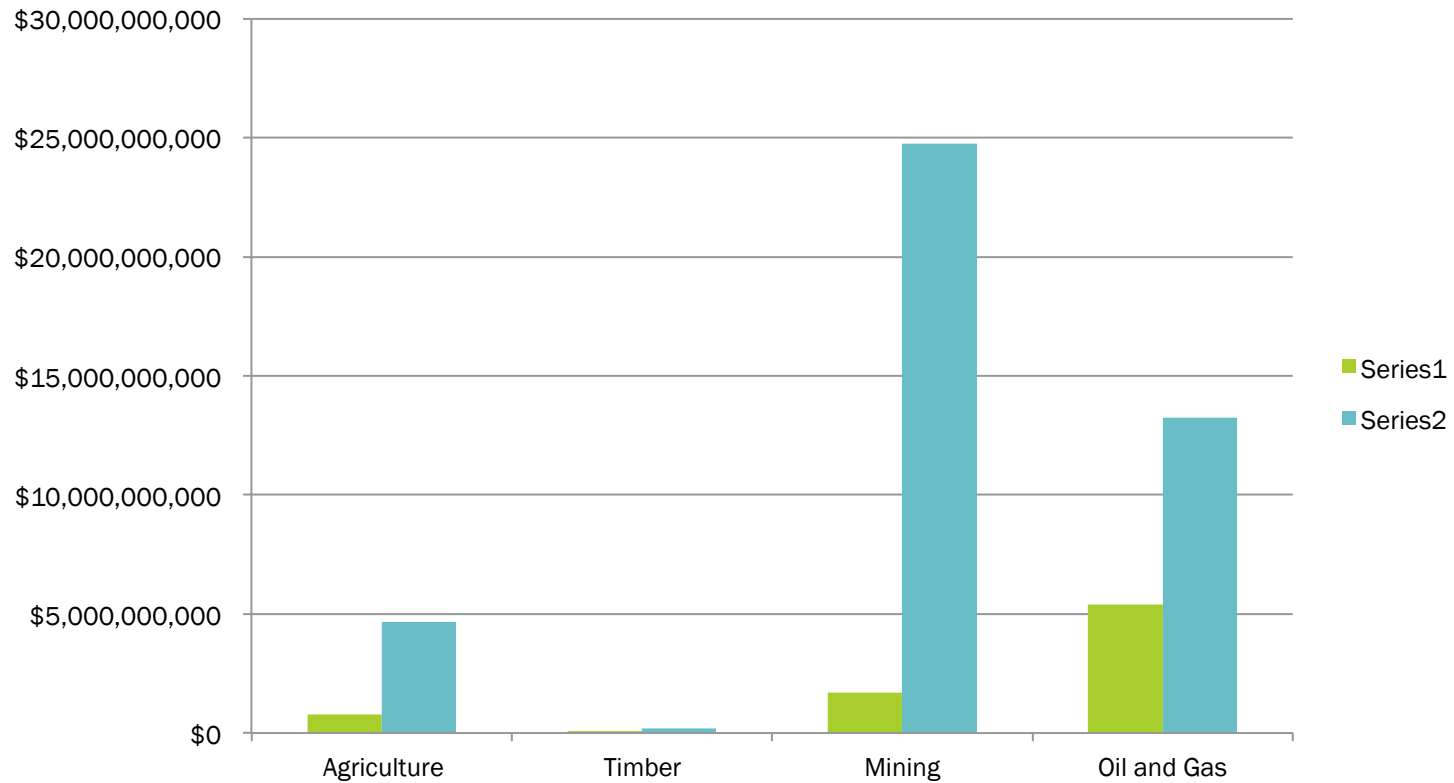
# LIBERIA RESOURCE SECTOR SUMMARY

## EXPORT MARKET



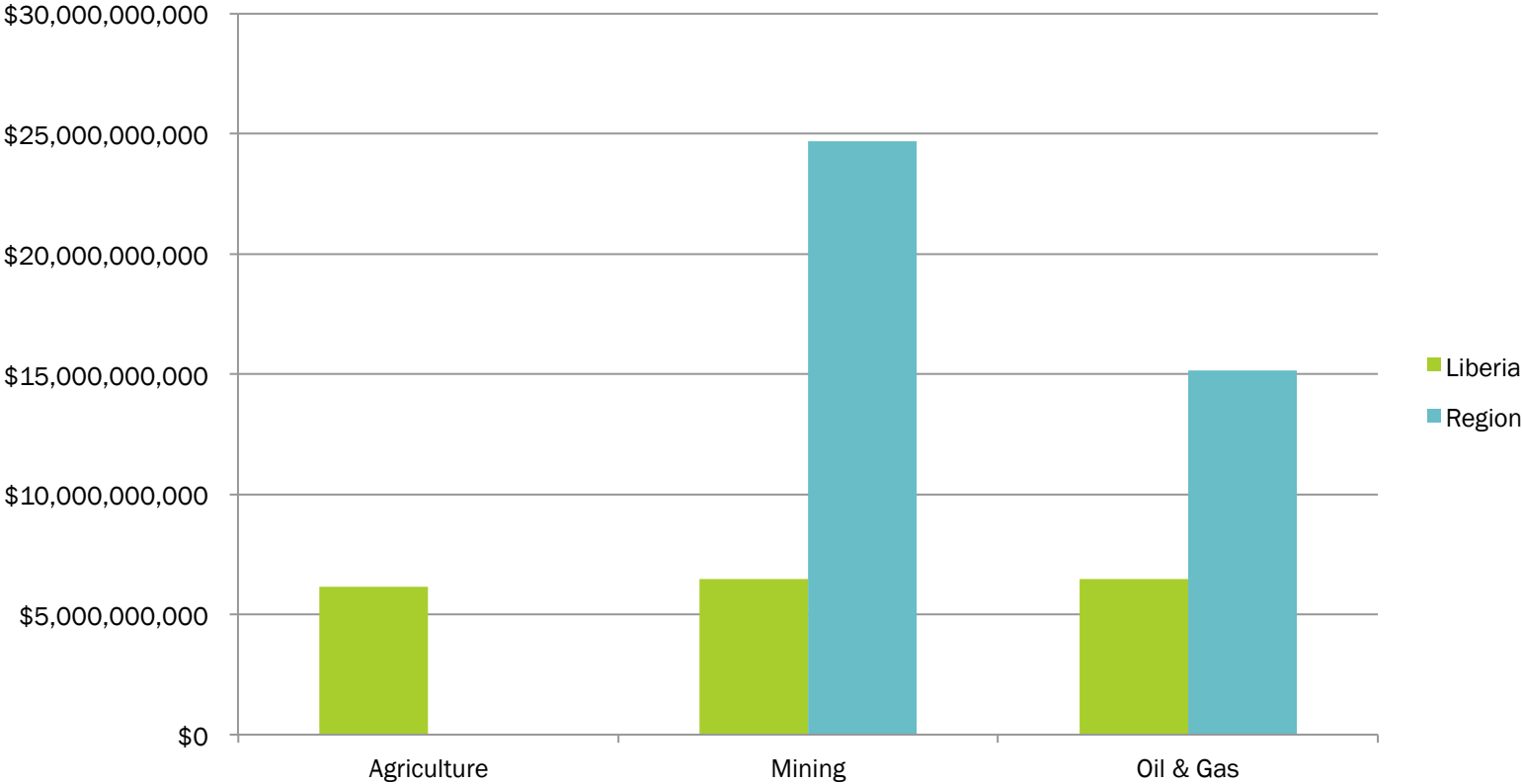
# REGION RESOURCE SECTOR SUMMARY

## EXPORT MARKET



Note on Timber: Regional Timber exports were not computed and only contain estimates for Liberia due to inability to capture parts of value chain of timber outside of region.

# LIBERIA & REGION RESOURCE SECTOR VALUE CHAIN<sup>1</sup> SUMMARY



<sup>1</sup> Represents total value chain, not value chain that could be realistically captured. Further analysis must be conducted to better estimate which portions could be captured based on feasibility, location, comparative advantages, and competitive analysis.  
Note on Agriculture: Regional Value Chain for Agriculture not computed since agricultural value chains reside in country and thus unable to be captured