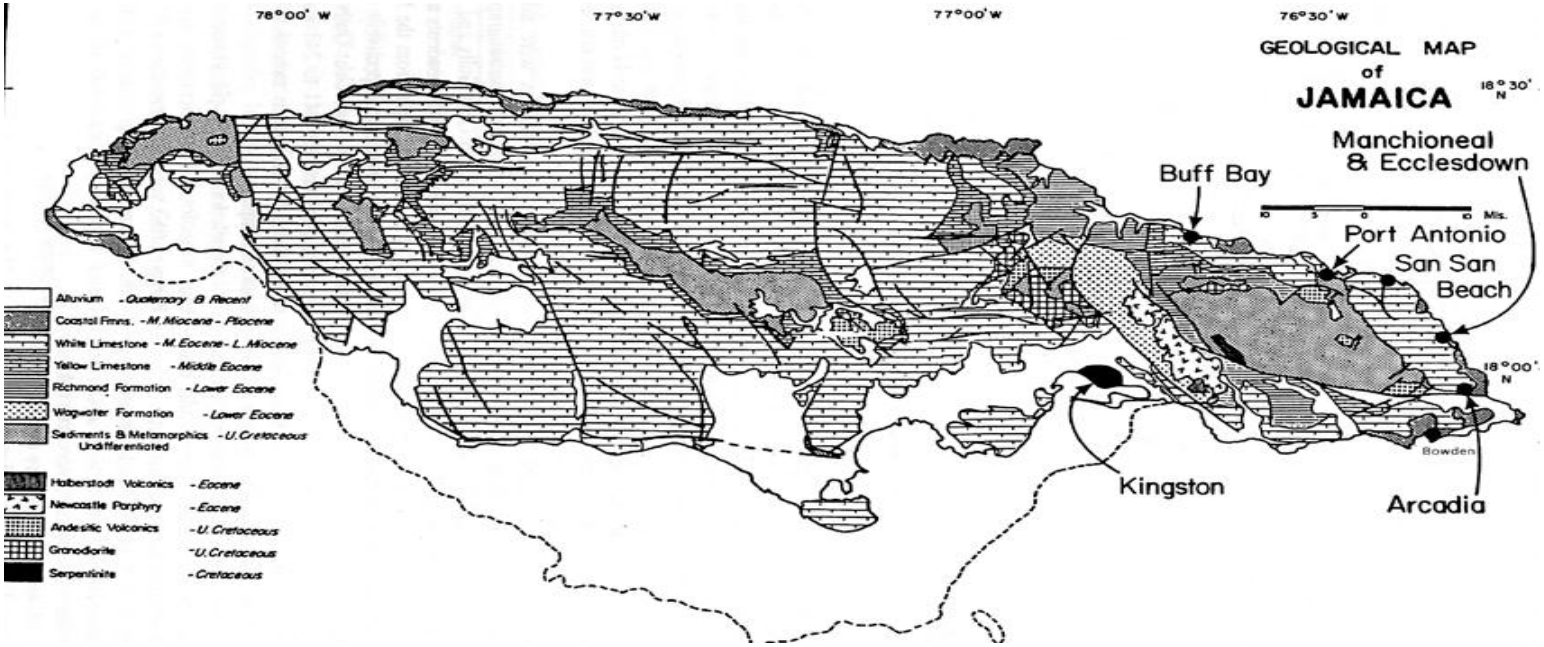


MARKET ASSESSMENT AND DESIGN AND IMPLEMENTATION OF A MARKETING INITIATIVE FOR LIMESTONE AND ITS DERIVATIVES

Presented by: **Conrad Douglas & Associates Limited**

Date: November 14, 2013

Purpose

- The purpose of this presentation is to:

1. Report on the findings of the study
2. Indicate the possible way forward
3. Stimulate discussion among the participants present at today's Symposium.

Table of Contents

- In making this presentation, CD&A will cover the following:
  - Background & Introduction
  - Findings:
    - Assessment of Market Opportunities
    - Assessment of Local Operations (Sector Assessment)
  - Conclusions
  - Recommendations
  - The Way Forward
  - Acknowledgements

Background & Introduction

- Conrad Douglas & Associates Limited (CD&A) was contracted by the Centre for the Development of Enterprise (CDE) and JAMPRO to **Conduct a Market Assessment and Design and Implement a Market Initiative for Jamaican Limestone and its Derivatives.**
- The CDE is an African, Caribbean and Pacific (ACP)/EU joint Institution created in the framework of the Cotonou Agreement.
- CDE's financial resources mainly come from the European Development Fund (EDF). Its objective is to ensure the development of professional ACP enterprises operating in the private sector.
- CDE operates in complementarity with the European Commission, the Secretariat of the ACP Group of States and the European Investment Bank in the framework of support to the private sector.

Background & Introduction

- The overall project consists of three (3) phases as follows:
  - **PHASE I: Market Assessment of Limestone and Value- Added Derivatives**

  - **PHASE II: Attraction of investment to the sector**

  - **PHASE III: Technical assistance to those companies entering new partnerships, implementing new product diversification plans, upgrading, environmental plans and/or other recommendations.**

Each phase is integrally related, with information from preceding phases forming a basis for informing succeeding phases.

- The critical parameters linking each phase has been emphasized to meet the overall objective of the project.

Background & Introduction

- The long term objective is **to foster the growth, competitiveness and sustainability of the sector**.
- The specific project objectives of Phase I are:
  1. To identify product development and market opportunities
  2. To undertake a sector assessment of the non-metallic minerals sector with focus on limestone and its value-added derivatives, including:
     - ✓ production capacity,
     - ✓ technology,
     - ✓ environmental management system,
     - ✓ legal and regulatory framework required

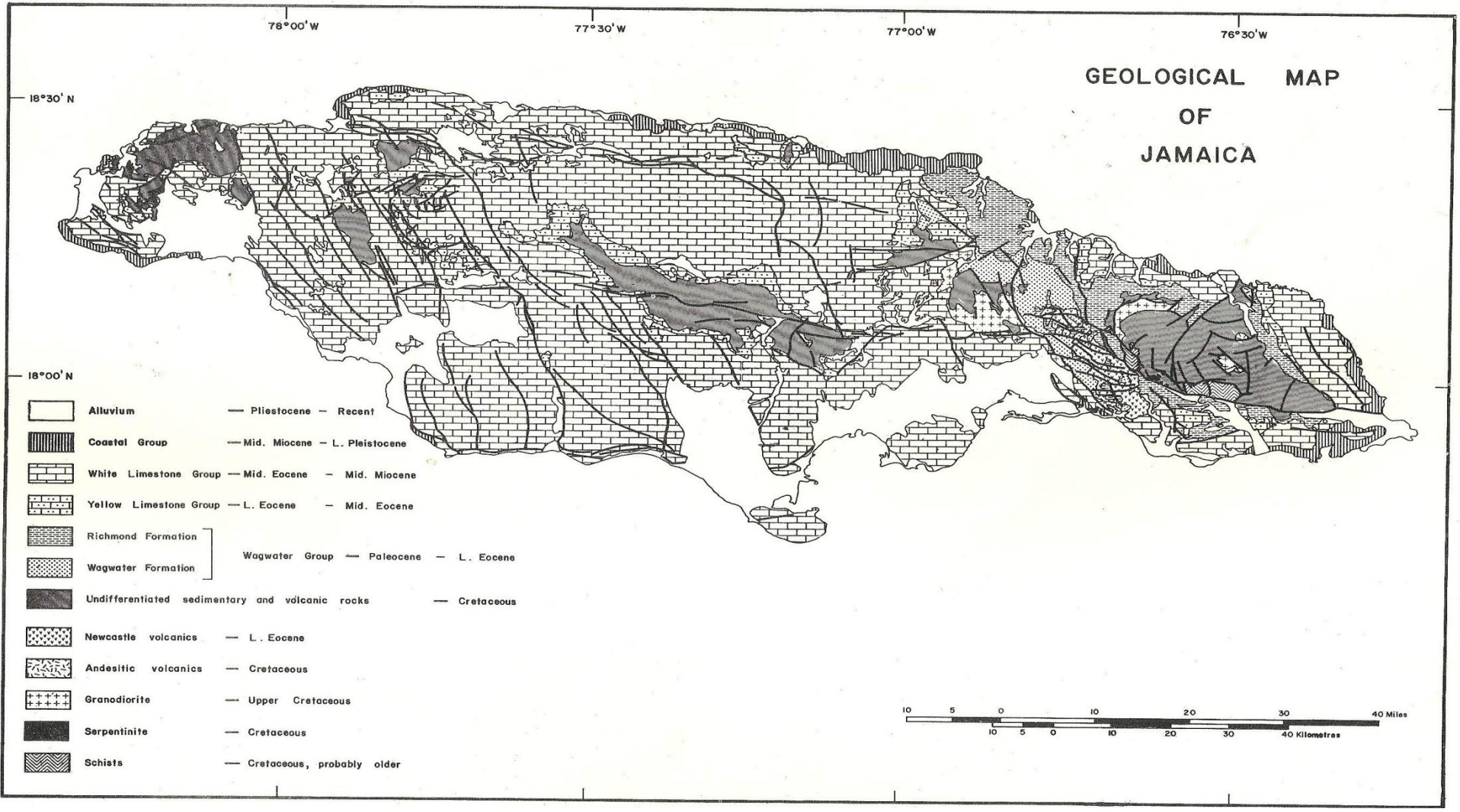
Background & Introduction

- The goal of Phase I of the project is to **provide a basis for further detailed studies** (contact market surveys, management audits, conceptual engineering designs, and feasibility studies) **that will stimulate and guide further development of the local limestone sector** so that **domestic and export market opportunities may be seized** through the **development of a vertically integrated high value added limestone industry**.

Background & Introduction

- This Phase I report is divided into two (2) main sections, and a third related section which points the way forward. All sections are integrally related. The sections are as follows:
  1. **An Assessment of Market Opportunities**
  2. **An Assessment of Local Operations (Sector Assessment)**
  3. **The Way Forward**

Assessment of Market Opportunities

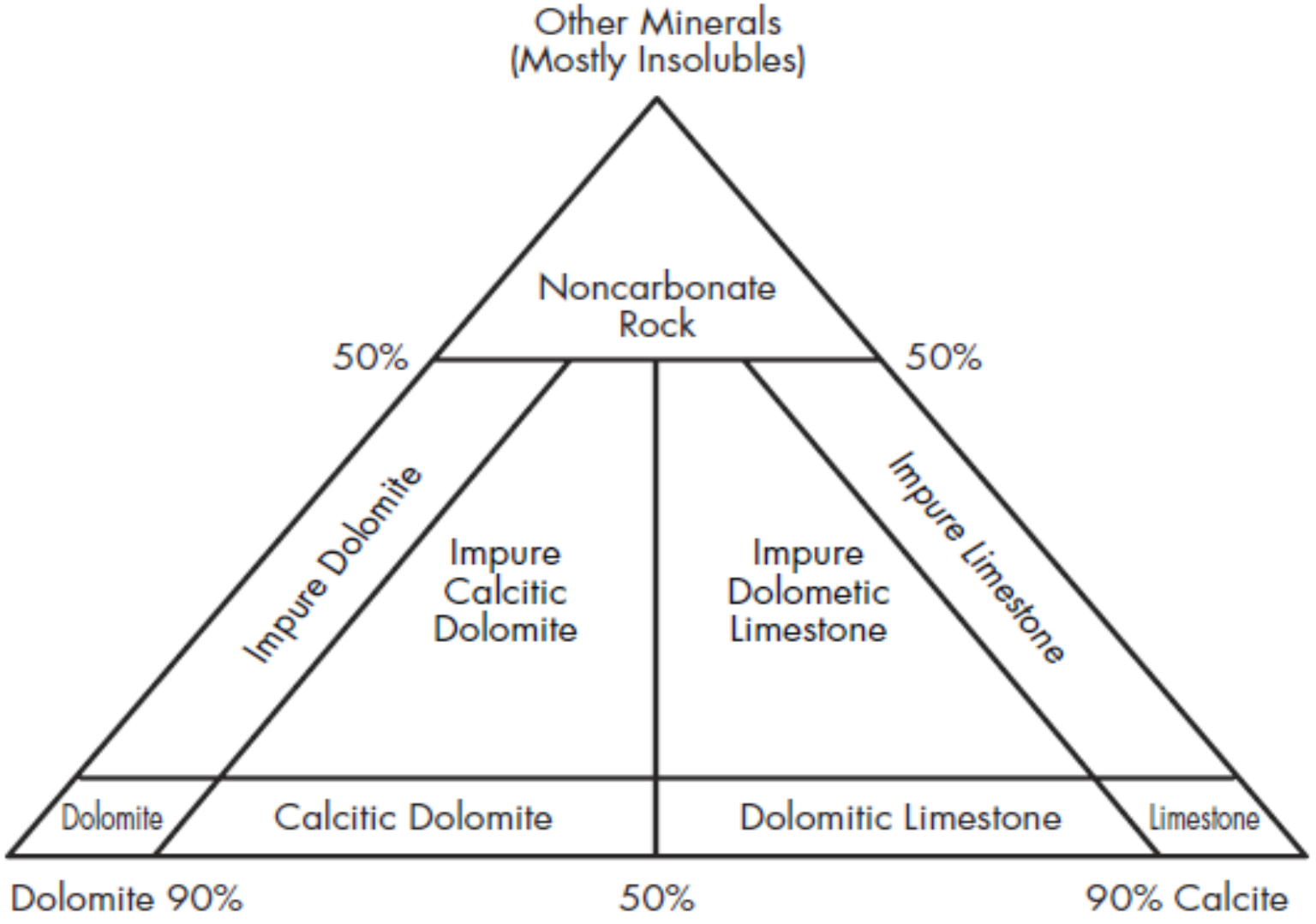


Jamaica has an abundance of high quality limestone. Approximately 60% of the island by weight and 80% of the total surface coverage comprises limestone. Tertiary White Limestone group covers 2/3 of the island.

It is estimated that there is a resource of150 billion tons of which 50 billion tons is recoverable.

<u>This presents diverse opportunities for the development of derivatives.</u>

Mineral Classification of Carbonate Rocks



Typical specifications for GCC used in Domestic Paint Industry

Chemical Analysis of raw material	
Calcium Carbonate (CaCO3)	99.7%
Iron Oxide (Fe2O3)	0.019%
Magnesium Carbonate (MgCO3)	0.17%
Aluminium Oxide (Al2O3)	0.27%
Moisture	0.084%
Physical Properties	
Specific Gravity	2.71
Hardness (Mohs)	3
Fineness	
Residue on a 45 sieve	Nil
Mean Particle Size	7.7
Particles < 22	99.6%
Particles < 2.9	3.9%
Whiteness	
Brightness	92.1%
Bulk (Packed) Density	1.1 g/cm3
pH value	9.8
Oil Absorption	17%
Plasticizer (DBP) absorption	23.5%
Application	Plastics*: Polyoefin, Plasticized and Unplasticized PVC, Pigment*

Chemical Specifications for Ultra-fine and Medium Fine GCC (International)

Chemical Properties	
Calcium Carbonate	96.5%
Magnesium Carbonate	2.0%
Silica and silicates	1.0%
Other	0.5%
Other Properties	
Color	White
Alkalinity (as NaOH, ASTM D-1208) [mg/gm]	0.4
pH (ASTM D-1208) [saturated solution]	9.4

Physical Specifications for Ultra-fine and Medium Fine GCC (International)

Parameter	Q325	Q200	Q200T	Q100	Q60	GeoTex FXZ	Q40-200	GeoTex FXT	Q12-40	Q6-20
Surface Treatment			**Treated**							
Median Particle size (LLS-Cilas)	13	22	22	24	20					
Dry Brightness (Hunter Reflectometer)	86	84	84	83	78					
Oil Absorption (lbs oil/100lbs, ASTM D-261	14	12	12	12	12					
Moisture	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Water Demand (ml/100gms)	40	36		36						
Loose Bulk Density (lbs/ft3, ASTM C-110)	50	55	55	55	55	89	85	90	90	90
Compacted Bulk Density (lbs/ft3, ASTM C-110)	60	80	80	80	95	110	98	106	100	100
Weight Per Gallon (lbs/solid gallon)	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Hegman Grind (ASTM D1210)	2									
Mesh Size										
-4										
-6										100
-8									100	85
-12									95	61
-16									72	28
-20						100	100	100	56	7
-40				100	100	99	99.5	99.5	7	
-60		100	100	99.9	99.6	71	60	60	3	
-100	100	99.9	99.9	99	96.5	48	23	23		
-200	99.9	99	99	79	78	27	6	6		
-325	99.5	82	82	66	61	17				

End Uses Cited by International Supplier of Ultra- and Medium-Fine GCC

- Adhesives
- Agriculture
- Asphalt Products
- Caulk and Sealants
- Ceramics
- Cleansers
- Drilling Fluids
- Joint Compound
- Paint and Coatings
- Pesticides
- PVC Pipe
- Rubber
- Traffic Paint
- Vinyl Flooring

Typical Specification for PCC used in Paints

Physical Properties	Metric	English	Comments
Specific Gravity	1.85 g/cc	1.85 g /cc	Slurry
Density	2.70 g/cc	2.70 g/cc	dry
Solids Content	1.84 g/cc	0.06667 lb /cc	Slurry
Moisture Absorption at Equilibrium	0.040%	0.040%	Moisture Loss 110C (dry)
Particle size	3.2um	3.2um	Median Diameter
Specific Surface Area	3.2m2/g	3.2m2/g	
Optical Properties	**Metric**	**English**	**Comments**
Refractive Index	1.5	1.57	dry
Reflection Coefficient, Visible (0-1)	0.955	0.955	Y – Brightness (dry)
Descriptive Properties			
Calcium Carbonate %		98	
FDA		21 CFR 174.5, 175.300, 178.3297	
Hegman (dry)		6	
Magnesium Carbonate		1	
Pounds Pigment/gallon (slurry)		1	
Pounds Pigment/Solid Gallon (dry)		11.3	
Retained in 325 mesh (dry) ppm		22.6	

Primary and Secondary Drivers of Market Demand in the Domestic and International Markets

- Food
- Clothes
- Housing
- Health
- Transportation
- Physical Infrastructure

Market Opportunities

- The market opportunities for the medium term included:
  - Limestone Aggregate,
  - Ground Calcium Carbonate (GCC),
  - Precipitated Calcium Carbonate (PCC),
  - Quicklime,
  - Additives in various kinds of building plasters (e.g. thinset and grout),
  - Worked and non-worked monumental stones that are cut or sawn from re-crystallized limestone (marble, travertine, or alabaster); and
  - Enamels & glazes, and engobes.

Domestic and Export Market Products for the Medium Term

Limestone Aggregate

Ground Calcium Carbonate (GCC)

Quicklime

Precipitated Calcium Carbonate (PCC)

Domestic and Export Market Products for the Medium Term

Thinset

Marble

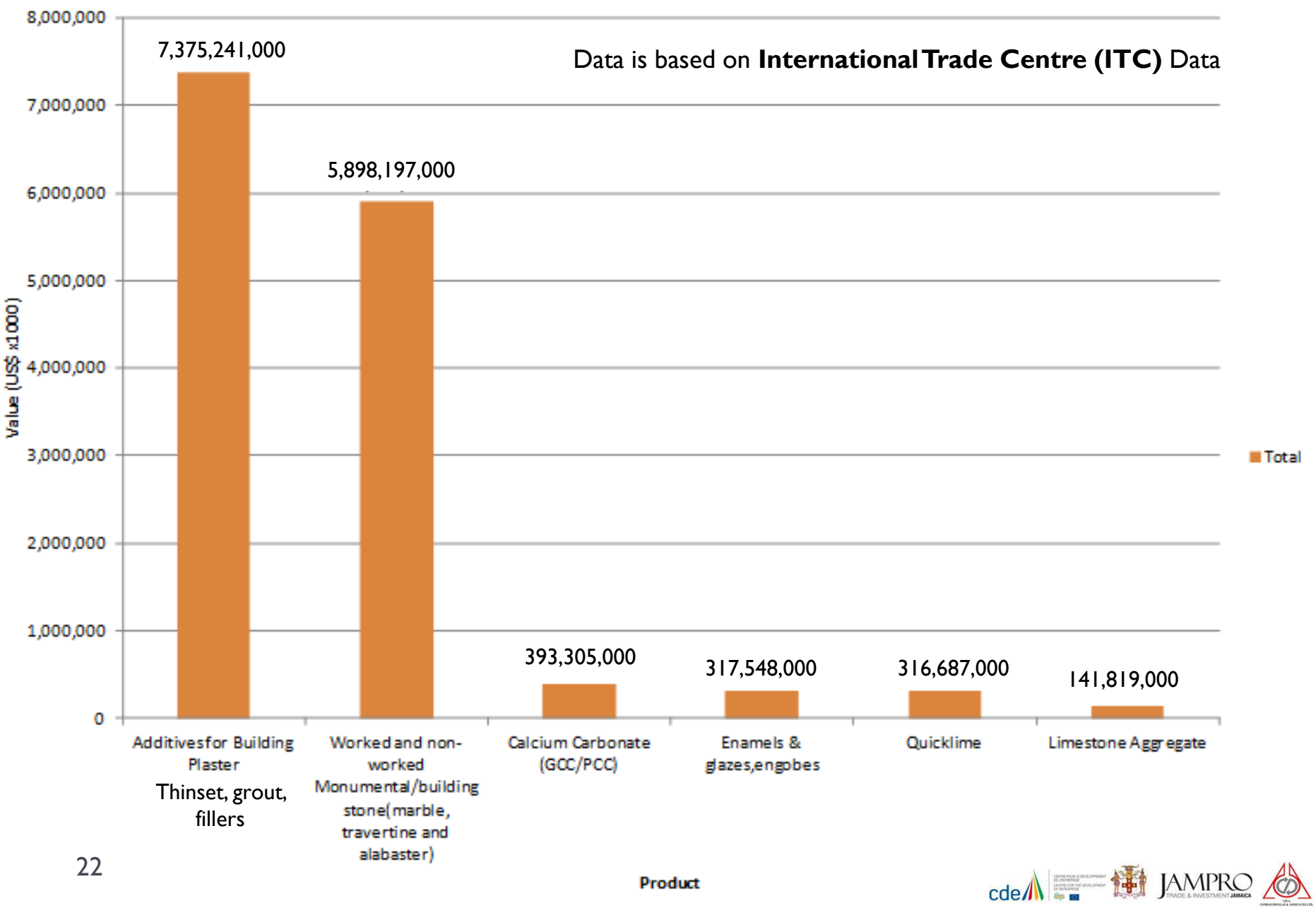
Alabaster

Travertine (limestone deposited by mineral springs, especially hot springs)

Target Markets

- The Regional and Extra-Regional markets that were assessed through desktop study were:
  - Caricom
    - Barbados
    - Guyana
    - Haiti
    - Suriname
    - Trinidad & Tobago
  - Central America
    - Costa Rica
    - Dominican Republic
    - El Salvador
    - Guatemala
    - Honduras
    - Nicaragua
    - Panama
  - North America
    - Canada
    - USA
  - South America
    - Brazil
    - Venezuela

Economic Value of Various Limestone Based Products Imported by Markets in the Targeted Countries (Cumulative for the Region) for the Period 2008 - 2012



Market Opportunities – Limestone Aggregate

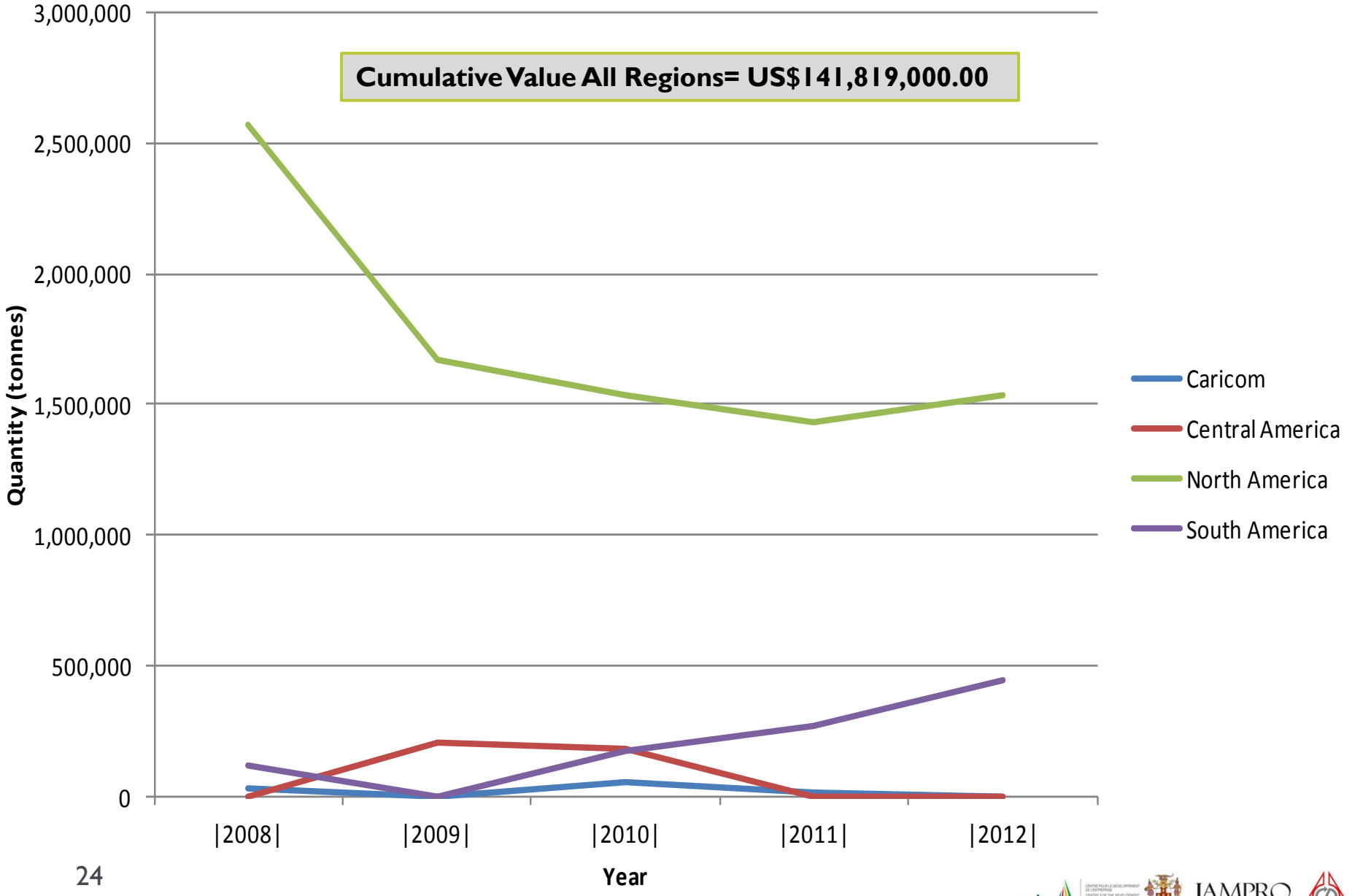
- The Domestic Market
  - **The Domestic Market for Limestone Aggregates is saturated.**
    - Influenced by underperformance of the local economy
    - Forecast is for significant improvement in the next three (3) years with major infrastructural and process industry development plans.

- Regional and Extra-regional Markets
  - Over the past five years the import data for the following regions is broken down as follows:
    - Caricom region imported approximately 93,300 tonnes of limestone aggregate valued at US$5 million;
    - Central America region imported 393,295 tonnes of limestone aggregate valued at US$1.6 million respectively;
    - North America region imported 8.7 million tonnes of limestone aggregate valued at US$121.5 million
    - South America imported 1million tonnes of limestone aggregate valued at US$13.7 million.
    - Overall the countries collectively imported 9.9 million tonnes of limestone aggregate, for a total value of US$142 million.

(The contact market survey is a first component in Phase II will be important to detail the size distribution and value)

This represents an opportunity to develop an export market for limestone aggregate from Jamaica, which will then have a market share of the lucrative business, provided that it can be done at more competitive terms than those being offered by the existing suppliers.

Quantity of Limestone Aggregate Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012



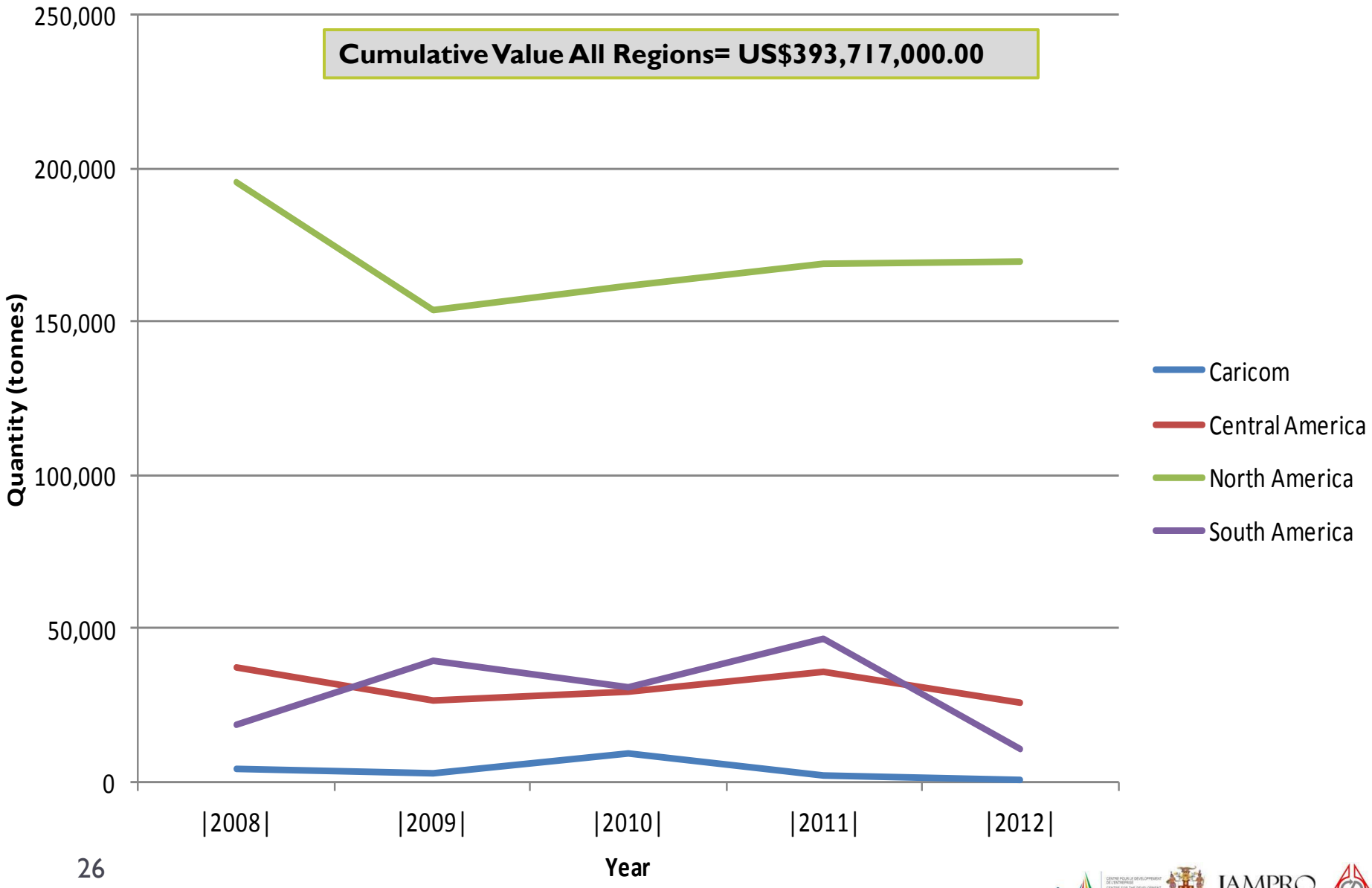
Ground Calcium Carbonate (GCC) and Precipitated Calcium Carbonate (PCC)

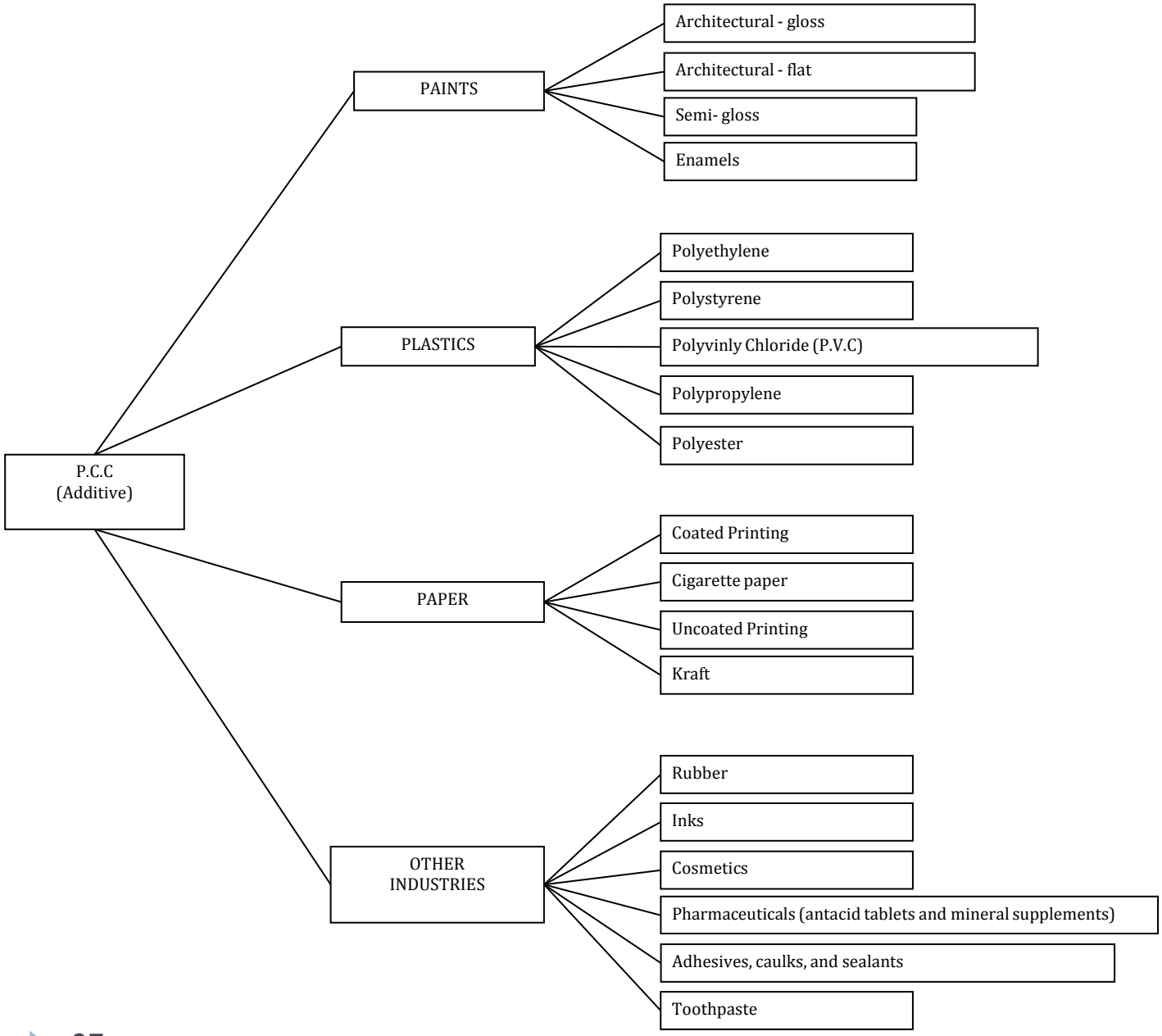
- Market opportunities exist for Ground Calcium Carbonate (GCC) and Precipitated Calcium Carbonate (PCC) for the domestic, regional and extra-regional markets.
  - The Domestic Market
    - 707 tonnes of PCC valued at US$534,370 was supplied to the Jamaican market from overseas sources for the period 2008 – 2012.
  - Regional and Extra-regional Markets
    - **Caricom**: A total of 19,000 tonnes of calcium carbonate (GCC/PCC) valued at approximately US$5 million was imported into the region from sources excluding Jamaica.
    - **Central America**: The targeted Central American countries imported a total of 110,000 tonnes of calcium carbonate (GCC/PCC) with a value of US$36 million over the period 2008-2012.
    - **North America:** During 2008-2012 the combined importation of GCC/PCC was 849,000 tonnes valued at US$242 million dollars
    - **South America:** During 2008-2012, the two countries considered in this group – Brazil and Venezuela, imported 147,000 tonnes of GCC/PCC with a combined valued at US$87 million.

On the basis of the high price for PCC, (ranges in price from US$355 – 450 per ton: 2013) its diverse end uses in the production of fine chemicals and pharmaceutical products such as calcium propionate, and calcium-magnesium supplements, as well as high grade paper, there is an opportunity for the establishment of a PCC plant.

The commercial viability of such projects would require the preparation of feasibility studies, basic engineering designs, and environmental impact assessments. It must be noted that two or more components of these projects may be implemented in integrated limestone chemical complex. For example: limestone aggregates, quicklime, hydrated lime, and PCC provide successive raw materials, intermediates and finished products for each succeeding operation.

Quantity of Calcium Carbonate (GCC/PCC) Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012




P.C.C
(Additive)
PAINTS
Architectural - gloss
Architectural - flat
Semi- gloss
Enamels
PLASTICS
Polyethylene
Polystyrene
Polyvinly Chloride (P.V.C)
Polypropylene
Polyester
PAPER
Coated Printing
Cigarette paper
Uncoated Printing
Kraft
OTHER
INDUSTRIES
Rubber
Inks
Cosmetics
Pharmaceuticals (antacid tablets and mineral supplements)
Adhesives, caulks, and sealants
Toothpaste

Production of high value-added products

- Going forward, domestic opportunities for the production of high value-added products should be explored before expanding to the regional and extra-regional markets.
- This is especially true for products that are integral to amenities, the maintenance of building infrastructure, and the facilitation of basic and/or necessary activities related to hygiene, and manufacturing and packaging.

Production of high value-added products

- In this regard, CD&A anticipates that the following items represent examples of viable value-added products:
- PLASTICS (Polymers)
  - Sheets
    - polypropylene on existing polystyrene thermoforming machinery
  - Fibres
    - Calcium carbonate is conventionally used in polyethylene (PE) or polypropylene (PP) woven bags, weaving tapes or bands to prevent splitting and fibrillation.
  - Extrusion coating
    - Calcium carbonate can be used in Low-density polyethylene (LDPE), Linear low-density polyethylene (LLDPE), High-density polyethylene (HDPE) and Polypropylene (PP) extrusion coating (e.g. milk, or 'box juice' containers)
  - Molding
    - Blow molding (plastic bottles and containers)
    - Injection molding (furniture, household appliances, and automotive parts such as bumpers, hub caps, trimmings, etc.)

Production of high value-added products

- Polymers (continued)
  - Flexible PVC
    - Cables
    - Flooring (leather cloth, wall coverings, tarpaulin and automotive underbody sealing.)
  - Pipes and Profiles
    - PVC Pressure pipes
    - PVC foam core pipes
    - PVC sewerage pipes and fittings
    - Profiles (windows etc)
    - Electrical conduits
  - Rubber, Elastomer and Thermosets
    - Tires etc
  - Motor Vehicle Parts

Production of high value-added products

- PAPERS, in particular
  - Toilet or facial tissue stock, in rolls or sheets
  - Toilet paper, cut to size or shape, in rolls or in sheets
  - Cartons, boxes and cases, of corrugated paper or paperboard
- TOOTHPASTE

Domestic Market for Top Ten Limestone and Lime based Imported Value added Products

Item Description	CIF (US$)	Quantity (kg)
Dietary and nutritional supplements (vitamins and minerals etc., both in tablets and powders)	US$26,115,113.58	1,096,080.00
Glazed ceramic tiles cubes and similar articles the largest surface of which is capable of being enclosed in a square the side of which is 7 cm or more.	US$24,064,713.24	40,114,631.74
Folding cartons boxes and cases of non-corrugated paper or paperboard	US$9,590,030.46	4,305,441.01
Toilet or facial tissue stock in rolls or sheets	US$8,894,894.71	5,292,029.97
Cartons boxes and cases of corrugated paper or paperboard	US$8,836,806.12	4,855,185.07
Soap (other than medicated soap) and organic surface-active products and preparations in the form of bars cakes moulded pieces or shapes for toilet use.	US$8,382,136.11	2,126,258.38
Napkins and napkin liners for babies of paper pulp paper cellulose wadding or webs of cellulose fibres.	US$7,869,346.41	2,021,910.65
Toothpastes	US$7,355,198.76	1,596,980.35
Toilet paper cut to size or shape in rolls or in sheets.	US$7,030,519.46	2,559,547.56
Sanitary towels and tampons of paper pulp paper cellulose wadding or webs of cellulose fibres.	US$5,606,502.03	718,985.58
Grand Total	**US$113,745,260.88**	**64,687,050.31**

Plastics

- Plastics are synthetic materials made from polymers. They can be molded into structures of varying shapes, strengths, and flexibility depending on their intended application.

- They are used in the production of frames for windows and doors, electrical conduits, tubes, pipes and hosing.

- Calcium carbonate is added as a filler in plastics and is used, in part, to modify the materials physical behaviour for appropriate performance under certain impacts or loadings.

Jamaica imported a maximum of US$9.8 million/yr and a minimum of US$6.2 million/yr worth of plastic products for the period 2009-2012

Paper

- Paper has diverse applications including printing, packaging, wrapping, covering, and various household applications related to cleaning and hygiene.
- It is produced from shredding and processing wood and/or other appropriate vegetative materials to form sheets that are made from the extracted cellulose fibres.
- Calcium carbonate is used as a filler to fill the grooves in the sheets of cellulose produced, forming a smooth surface.
- It also used as a constituent in the pigments that are used to coat certain types of paper in order to give particular colour and gloss to the surface.





Jamaica imported a maximum of US$25/yr million and a minimum of US$23 million/yr worth of the viable paper products for the period 2009-2012

Toothpaste

- In certain types of toothpaste precipitated calcium carbonate is used as an abrasive.
- The abrasive functions as a scrub to remove plaque and other solid materials from the surface of teeth.
- The abrasive is also formulated to give the toothpaste a certain type of consistency which affects the behaviour of the paste as it is forcibly discharged from its tubing.

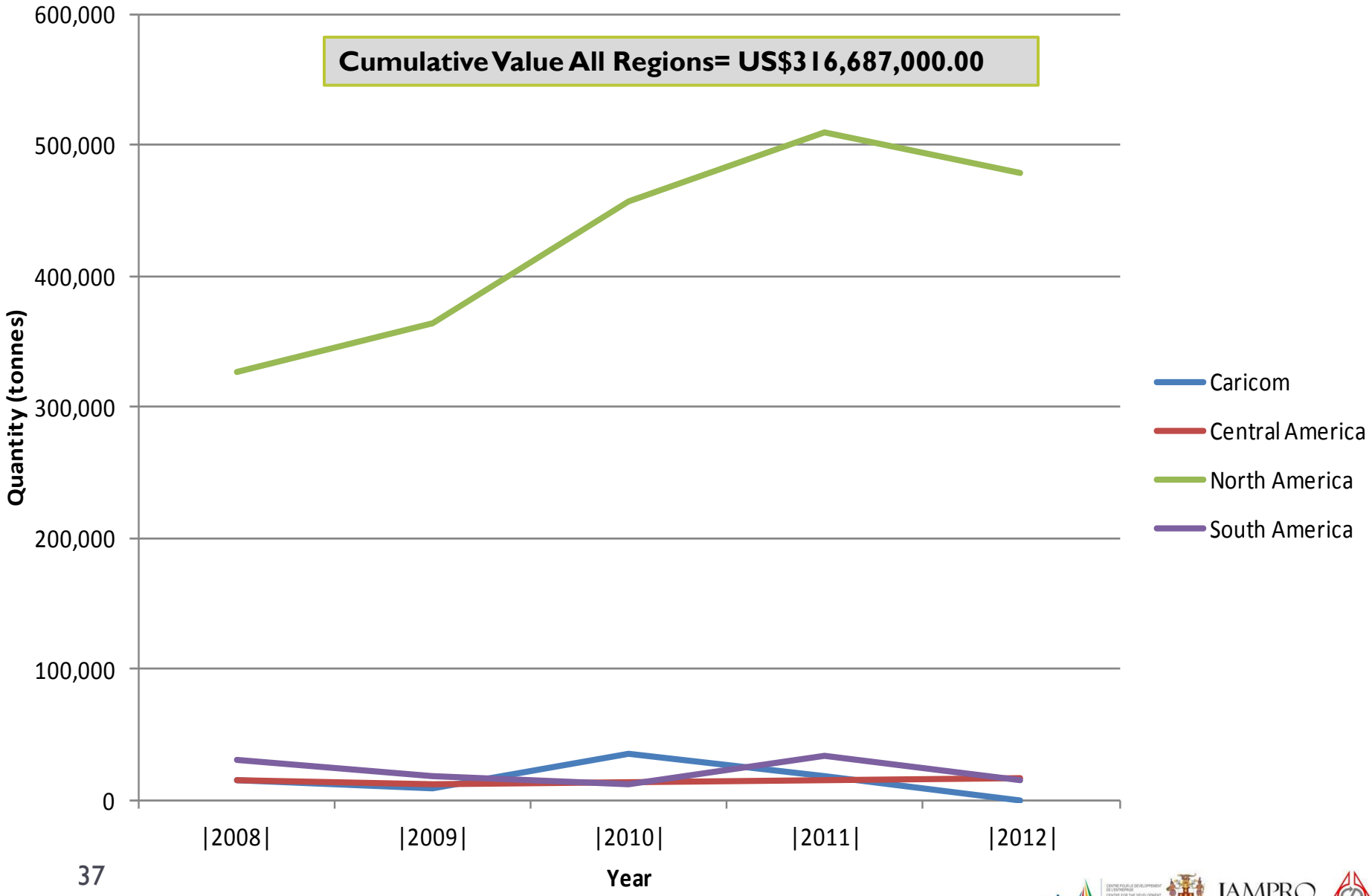
Jamaica imported a maximum of US$8 million/yr and a minimum of US$6.5 million/yr worth of toothpaste products for the period 2009-2012

Quicklime

- **Domestic Market**: Over the past five years Jamaica imported 56,500 tonnes of quicklime valued at US$11.8 million to supplement locally produced volumes.
- ***Regional & Extra-regional Markets***
  - **Caricom**: The combined importation of quicklime by the targeted Caricom countries over the past five years was 76,479 tonnes at a value of US$14.2 million. This and other markets in Caricom would provide opportunities for lime produced from a facility in Jamaica.
  - **Central America**: The markets in the targeted Central American countries imported a total of 22,750 tonnes of quicklime with a value of US$2.86 million over the period 2008-2012.
  - **North America**: During 2008-2012 the combined importation of Quicklime was 2,134,663 tonnes valued at US$275.3 million dollars
  - **South America**: During 2008-2012, the two countries considered in this group – Brazil and Venezuela, imported 108,720 tonnes of Quicklime with a combined value of US$16.7 million.

The medium term prospects for increased earnings from this value added limestone product is linked to replacement of the imported quantities from locally produced operations which could almost immediately replace the average annual spend of US$2 million on importation over the past two years.

Quantity of Quicklime Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012

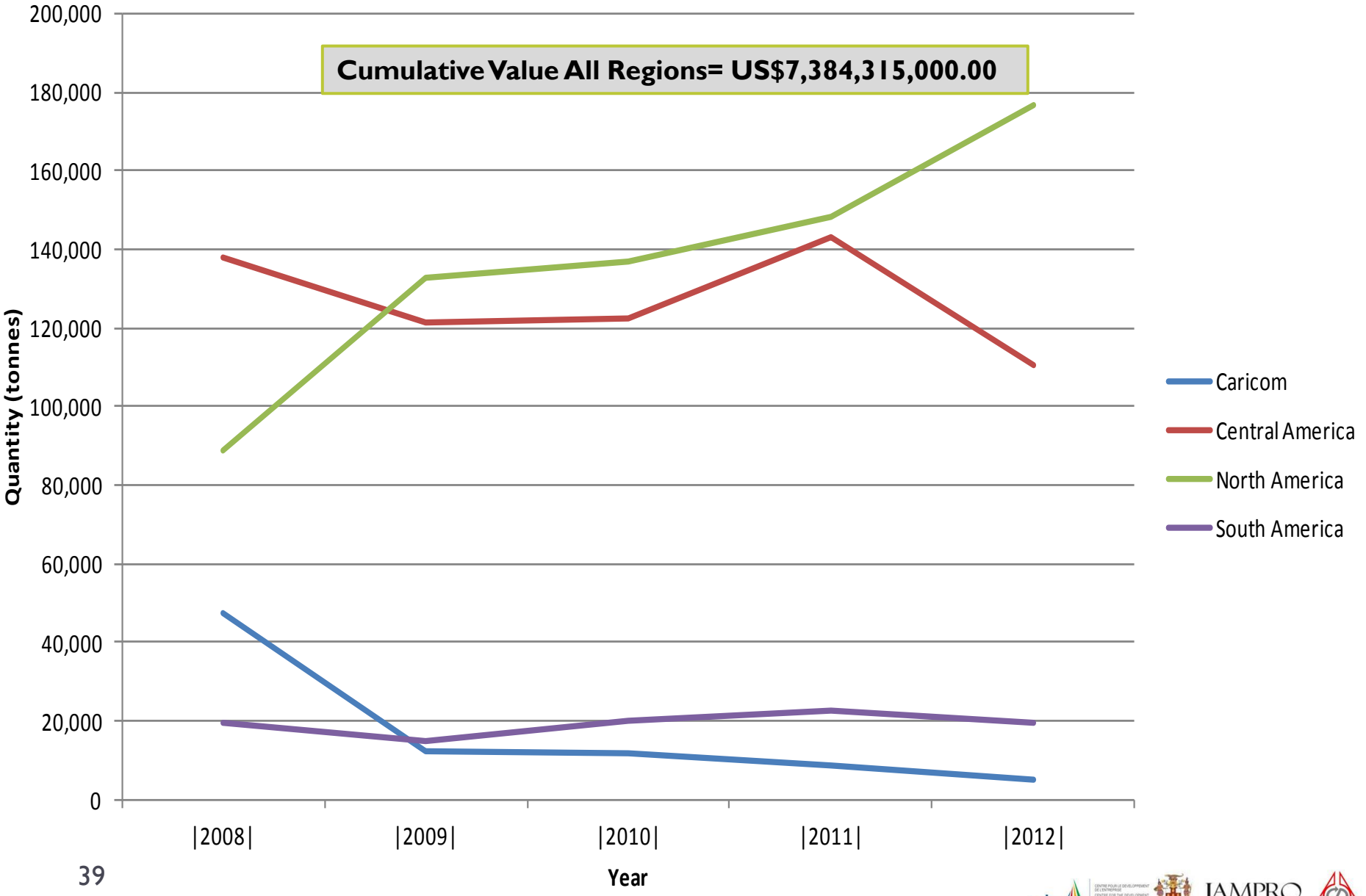


Additives in Building Plasters (thinset, grout, fillers, etc)

- Domestic Market
  - There are about six(6) local manufacturers of grout, thinset, and other building plasters.
  - These companies currently use GCC produced locally and imported lime in their formulation.
  - In addition to local manufacturing , the total imported into Jamaica for the period 2008-2012 was 3,542 tonnes, valued at approximately US$785,000

- Regional and Extra-regional Markets
  - For the period 2008-2012 the import data for additives in building plaster for the following regions is broken down as follows:
    - **Caricom region** imported approximately 85,512 tonnes valued at US$46.8 million;
    - **Central America** region imported 635,312 tonnes valued at US$1.12 billion
    - **North America** region imported 683,024 tonnes valued at US$5.87 billion
    - **South America** imported 96,639 tonnes valued at US$341 million.
    - **Overall the countries collectively imported 1.5M tonnes for a total value of US$ 7.4 billion.**

Quantity of Additives for Building Plaster Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012

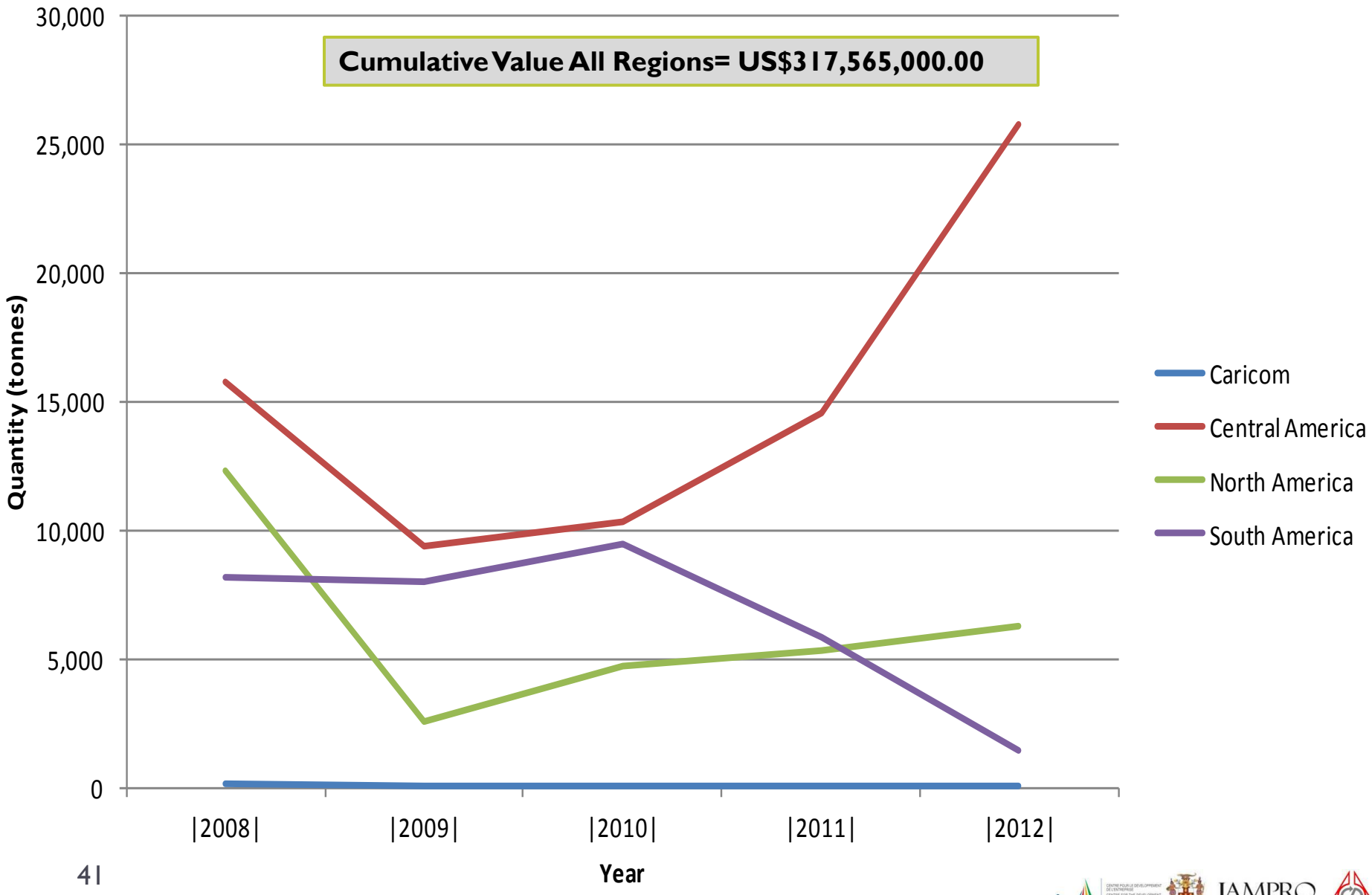


Enamels & Glazes and Engobes

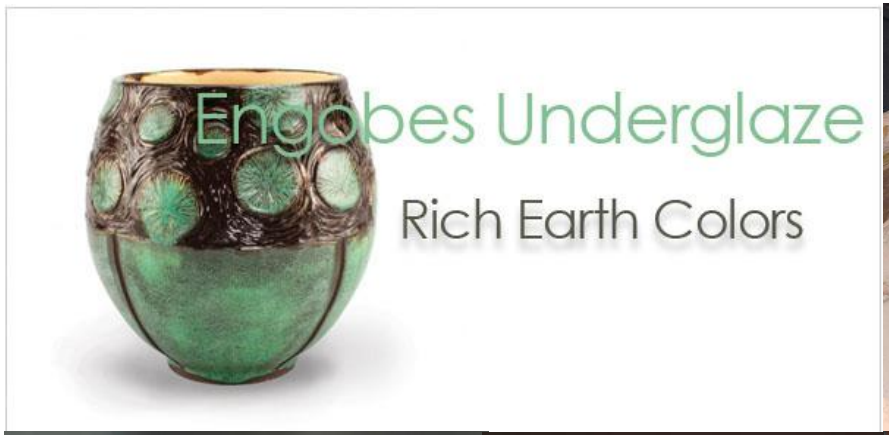
- **Domestic Market**: For the period 2006-2010, Jamaica imported a total of 19 tonnes of Enamels & Glazes and Engobes with a value of US$37,000.
- ***Regional & Extra-regional Markets***
  - **Caricom**: Over the period 2008-2012, a total of 354 tonnes of Enamels & Glazes and Engobes with a value of US$555,000.00 imported in the region.
  - **Central America**: The targeted Central American countries imported a total of 75,785 tonnes of Enamels & Glazes and Engobes with a value of US$ 181.4 million over the period 2008-2012.
  - **North America** region imported 31,192 tonnes of Enamels & Glazes and Engobes valued at US$75.8 million
  - **South America** imported 33,018 tonnes of Enamels & Glazes and Engobes valued at US$59.7 million.
  - **Overall the countries collectively imported 140,349 tonnes of Enamels & Glazes and Engobes, for a total value of US$317 million.**

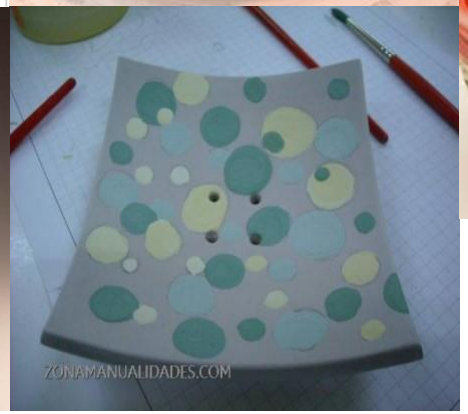
Engobes are either natural clays or a mixture of clays and ceramic raw materials, and are typically rich earth colors and subdued tones. Only water is added to obtain a working consistency like thick cream.

Quantity of Enamels & Glazes and Engobes Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012



Enamels & Glazes and Engobes



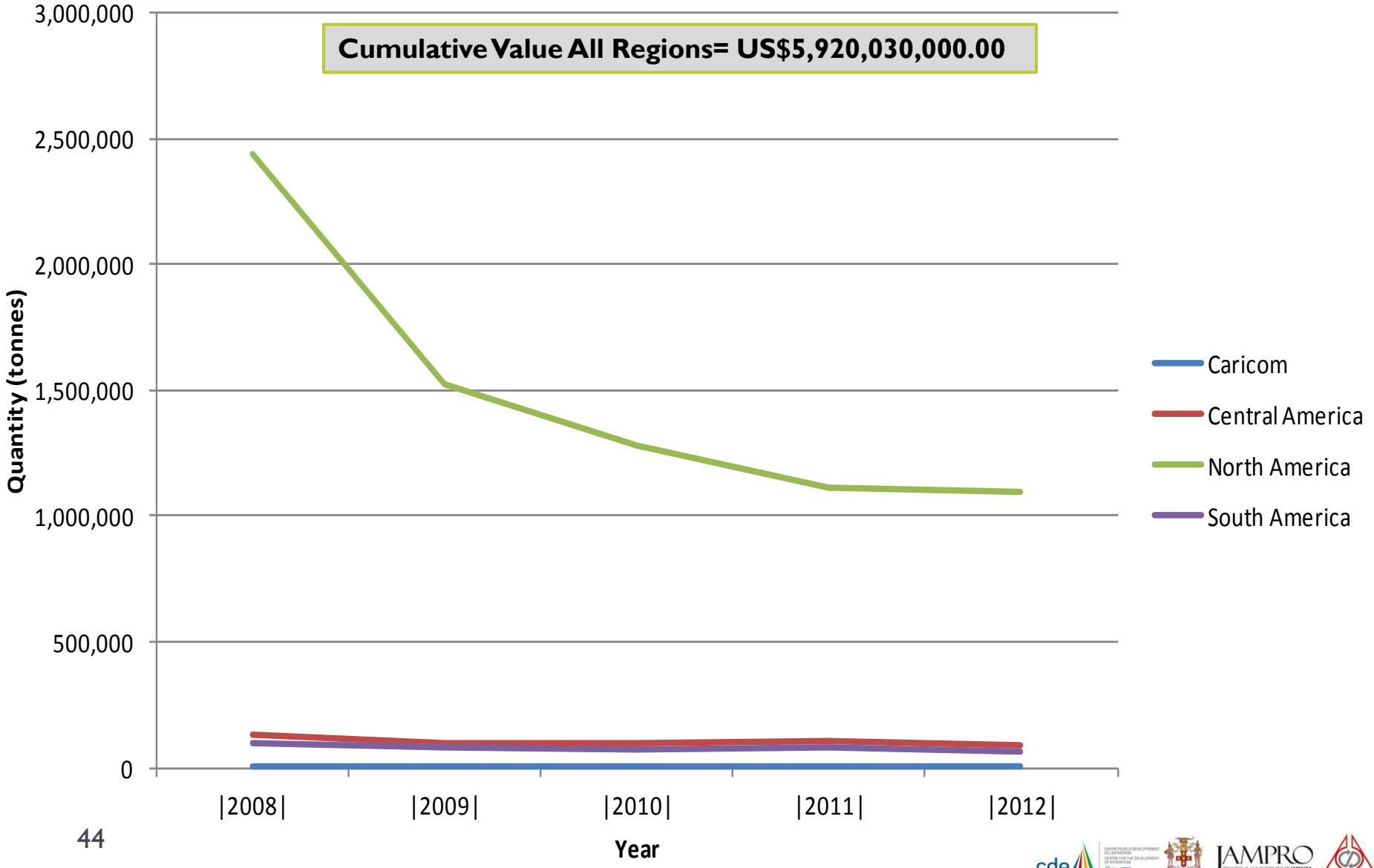


Worked and Non-worked Monumental Stones (marble, travertine, and alabaster)

- The Domestic Market
  - For the period 2006-2010, Jamaica imported a total of 8,230 tonnes of Worked and Non-worked Monumental with a value of US$14.7 million.

- Regional and Extra-regional Markets
  - For the period 2008-2012 the import data for Worked and Non-worked Monumental Stones (marble, travertine, and alabaster) the following regions is broken down as follows:
    - **Caricom region** imported approximately 10,866 tonnes valued at US$19.8 million;
    - **Central America** region imported 516,603 tonnes valued at US$357 million respectively;
    - **North America** region imported 7.45 million tonnes valued at US$5.24 billion
    - **South America** imported 393,430 tonnes valued at US$269.6 million.
    - **Overall the countries collectively imported 8.3 million tonnes for a total value of US$ 5.9 billion.**

Quantity of Worked and Non-worked Monumental Stones (marble, travertine, and alabaster) Imported by Markets in the Targeted Countries in Various Regions for the Period 2008 - 2012



ALABASTER

CLAY PRODUCTS

Worked and Non-worked Monumental Stones (marble, travertine, and alabaster)

- Handicraft products should be developed from these non-metallic mineral resources.
- Tourism sector
- Diaspora
- Gifts
- Souvenirs
- Combinations with wood and metals
- Formal relationship with Design Institutions
- Training integrated into industrial art courses of Primary and Secondary schools
- The distribution trade in commerce (crafts shops, duty-free shops), locally and internationally should be engaged.

Assessment of Local Operations (Sector Assessment)

Findings

- Production Capacity
  - Most companies reported operating at just above break even point, or are closed.
  - Only ten (10) of thirty (30) companies surveyed were operating consistently, but at reduced installed production capacities.
  - All operating quarries were operating well below installed capacity at no more than 50%.
    - **This results from the low market demand consequent on reduced activity in the construction sector. This relates to the low growth in the economy.** Building construction and infrastructure developments are stated to be at an all-time low.
  - Several operators have not reassessed their reserves status and can only advise "years of reserves" remaining.
    - Lydford Mining Company Limited (LMCL) and Chemical Lime Company of Jamaica Limited have had extensive core drilling done and have updated, proven reserves.

Findings

- Assessment of Products
  - Products:
    - Construction aggregate
    - Fill Material
    - Neutralizer
    - Asphalt Sand
    - Fertilizer Grade GCC
    - Animal Feed GCC
  - Except for one quarry operator, none of the operators surveyed are exporting limestone in bulk. That quarry operator exports:
    - Crushed aggregate
    - Limestone for flue gas desulphurization,
    - Whiting grade limestone (in bulk), and
    - Ground Calcium Carbonate (GCC), in 25kg bags.
- Limited cash flows cause some of these companies to be operating with very low stockpiles and producing only on an as-needed basis.
- Of significant importance is that some operators depend on integrated, subsidiary block-making facilities to generate and support cash flows.

Findings

- Technology, Equipment and Processes Applied
  - The establishment of crushing systems, except for two operators, continues to be conventional crushing and screening processes with fixed plants.
  - One operator utilizes a track mounted crushing and screening system at one location fed by an excavator while deploying at another companion location specially selected crushing and screening systems for the product types required.
  - The other deploys a series of track mounted crushing and screening systems in tandem which follow the mine face and is fed by an excavator.

Findings

- Technology, Equipment, Processes Applied
  - The companies are unable to upgrade or expand due to the high cost of financing, even if the markets were to open up.
  - Plant and quarrying machinery and equipment were generally aged, upwards of 20 years old and reliability was challenging. Machinery and equipment experiences frequent breakdowns and are in need of replacement. Complaints were made that the replacement parts were costly.
  - Many quality specifications provided were dated. Quality (chemical and physical) determinations in some instances are done to meet bid proposals.

Findings

- Environmental Management
  - Every effort is made to operate at safe and environmentally acceptable conditions but in a time of depressed throughput these may be compromised.
  - Most of the operations do not have water wells or a supply of municipal water and this has to be trucked in at a cost. Some operators harvest rain water.
    - Dry crushing has to be done.
  - Dust emissions are not necessarily under positive control. Similarly, wetting of the site is limited. Unless the sites are remote from communities, operations are curtailed at high winds.
  - Except for the larger operations mine benches and faces are not well defined and attention is required in this area.

Management and Organization

- The operations visited had generally knowledgeable and experienced managers in place to drive the process.
- Machinery and equipment operators were also well experienced, some relocating from the bauxite-alumina industry with the downturn in that industry.
- Additionally, the companies reported that on-the-job-training is the primary method of skills upgrading.
- Equipment operators are not in short supply but some operators complained of skilled, experienced artisans migrating.

When the industry plans to enter an expansion mode then additional training needs will become necessary.

Findings

- Major Challenges
  - A lack of port facilities
    - Port facilities (shared or tonnage determined for a stand alone facility) for bulk loading of limestone are essential if Jamaica is to realize real benefits from the vast limestone reserves of excellent quality; otherwise the industry will remain in stagnation.
  - The companies surveyed point to the high cost of energy.
    - Some of those on the JPSCo. grid terminate the supply in favour of own generation but even so complain of the high cost of fuel.
  - Operators complain about the high cost of lubricants, spare parts and other inputs.

Findings

- Major Challenges
  - The industry requires incentives similar to those given to foreign companies.
    - **It is noteworthy that these incentives will be repealed under the new tax incentive scheme – Omnibus Act, to be ready by end of year (December 2013)**
  - A complaint made is that illegal quarry operators are underselling licensed operators.
  - One quarry operator in an as-needed mode, complained of extortion, theft of fuel and lubricants. The extortionists turn up once the operator starts supplying material. This quarry is in a remote location.

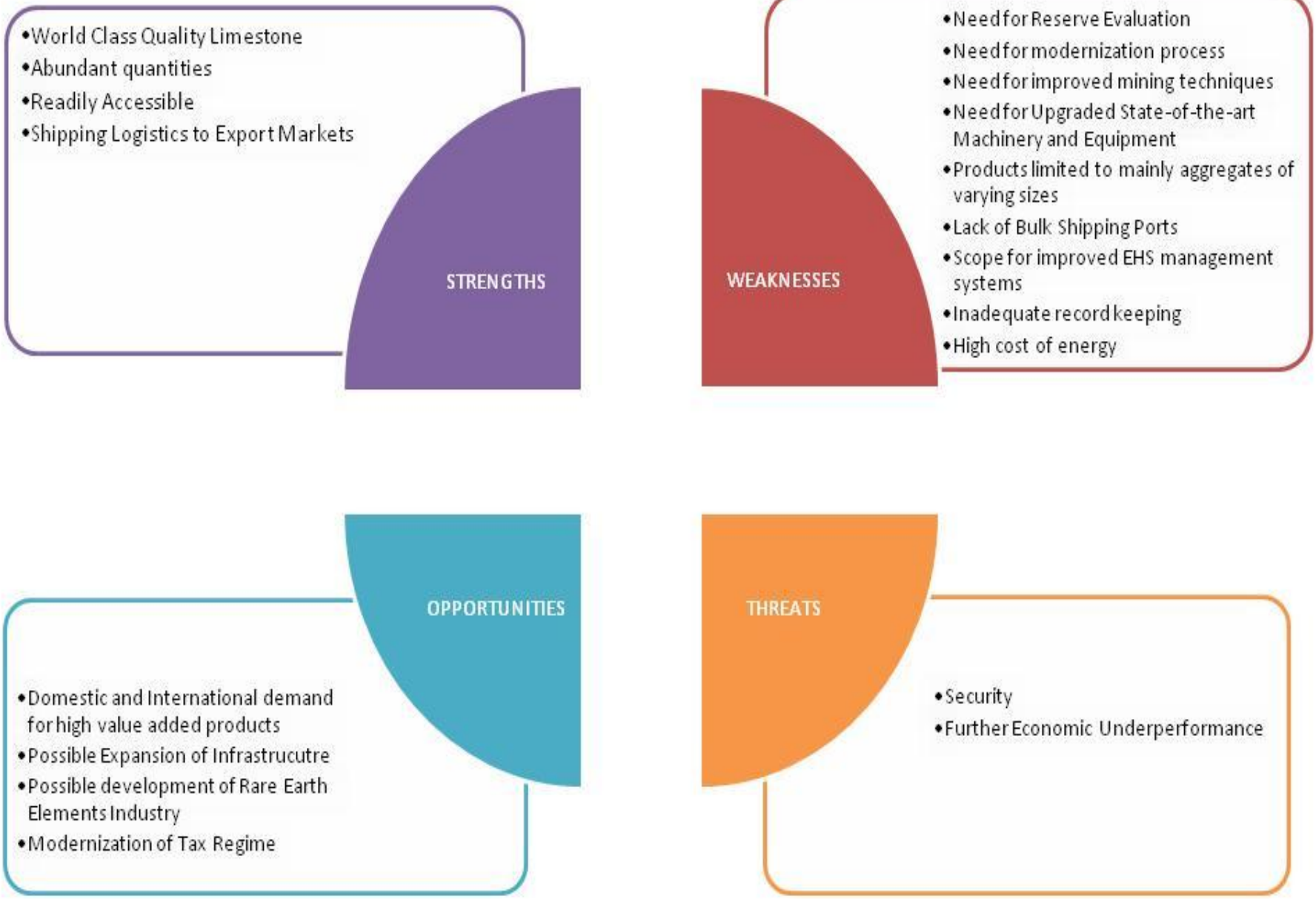
Review of the Regulatory Framework

- The following potential environmental impacts from the limestone industry were reviewed:
  - Physical Impacts
    - Fugitive dust emissions
    - Noise and vibration
    - Water quality
    - Geology, geotechnical and drainage
    - Aesthetics
  - Biological Impacts
    - Loss of biodiversity
  - Socio-economic and socio-cultural Impacts
    - Employment & Worker Health and Safety
    - Archaeological and historical heritage
    - Traffic
    - Solid waste management
    - Sewage treatment and disposal

Review of the Regulatory Framework

- A total of 48 pieces of legislation related to the following were compiled and assessed:
  - Mining Legislation
  - Environmental Legislation
  - Land Use Legislation
  - Taxation Legislation
  - International Agreements
  - Other Operating Statutes

SWOT Analysis of the Limestone & Derivatives Industry



GAP ANALYSIS

STATUS OF THE LIMESTONE QUARRY OPERATIONS

- Lack of qualitative and quantitative resource assessment
- Need for improved mining techniques. Outdated Machinery and Equipment
- Products limited to mainly aggregates of varying sizes
- Lack of Ports
- Scope for improved EHS management systems
- Inadequate record keeping.

INTERVENTION (Resource Assessment, Engineering, Environmental Management, Health & Safety, Training, Financial Assistance, Product Development, Promotion & Marketing)

- Resource Evaluation
- State-of-the-art machinery and equipment and mining techniques
- New PCC Industry
  New Quicklime Industry
  GCC Industry
  Value Added Manufacturing
- New Limestone shipping ports and increased port utilization
- Compliant EHS management systems
- Modern database management of operations

Modern, State-of-the-Art Limestone Industry

- ***Resource Evaluation***
  Quality Monitoring Programmes
- ***Management Plans***
  Environmental, Health & Safety Plans
  Mining Plans
- ***Training, Research & Development***
- ***Business Plans***
  Feasibility Studies
  Engineering Designs
  become integral to drive operations and development

Conclusions

- In developing the sector an international **Contact market study** as a first component of phase II is critically important.

- There are a number of opportunities in the domestic and regional markets for the utilization of Jamaica's high grade limestone resources.
  - Food and Pharmaceuticals
  - Building construction (Limestone based plastics, fillers and extenders)
  - Transportation sector (Automobile parts, wheels, hubcaps, bumpers, dashboards)
  - Packaging products (Paper)
  - Glazes
  - Earthenware
  - Craft Items

- The sector is in need of greater intervention, as planned to take place in Phase II

Recommendations

- The Jamaican limestone industry is in need of intervention to seize the opportunities that exists.
- Strategies integrating the resource with international markets, technology and capital must be pursued.
- The future of the sector will be dependent on engaging in the production of high value added products.
- Creation of new ports and increase capacity utilization of existing ports must be pursued
- The feasibility for the establishment of a PCC Plant must be pursued
- The high cost of energy must be addressed.
  - Recent initiatives for new power plants and renewables, especially based on Jamaica's roadmap for the energy sector augers well for the future

THE WAY FORWARD

THE WAY FORWARD

- The first focus of Phase II must be a special sub-component to conduct a Contact Market Survey.
- The North-South Highway link as well as the Logistics Hub will offer opportunities for the utilization of aggregates.
- A viable rare earth metals industry as well as revitalization and expansion of the alumina industry could also increase the demand for lime in the future.
- High value added formulation products in which GCC and PCC are used as fillers and extenders must be pursued. Such as toothpaste, pharmaceuticals, paper products, plastics.

THE WAY FORWARD

- Jamaica needs to establish a dedicated Minerals Institute to focus on and to drive the development of the limestone industry and the non-metallic minerals sector in general.
  - This does not need to start from scratch but takes on board existing institutions and formal strategic relationships and authoritative decision making among the leaders of the institute.
  - R&D and innovation must be a part of mining school

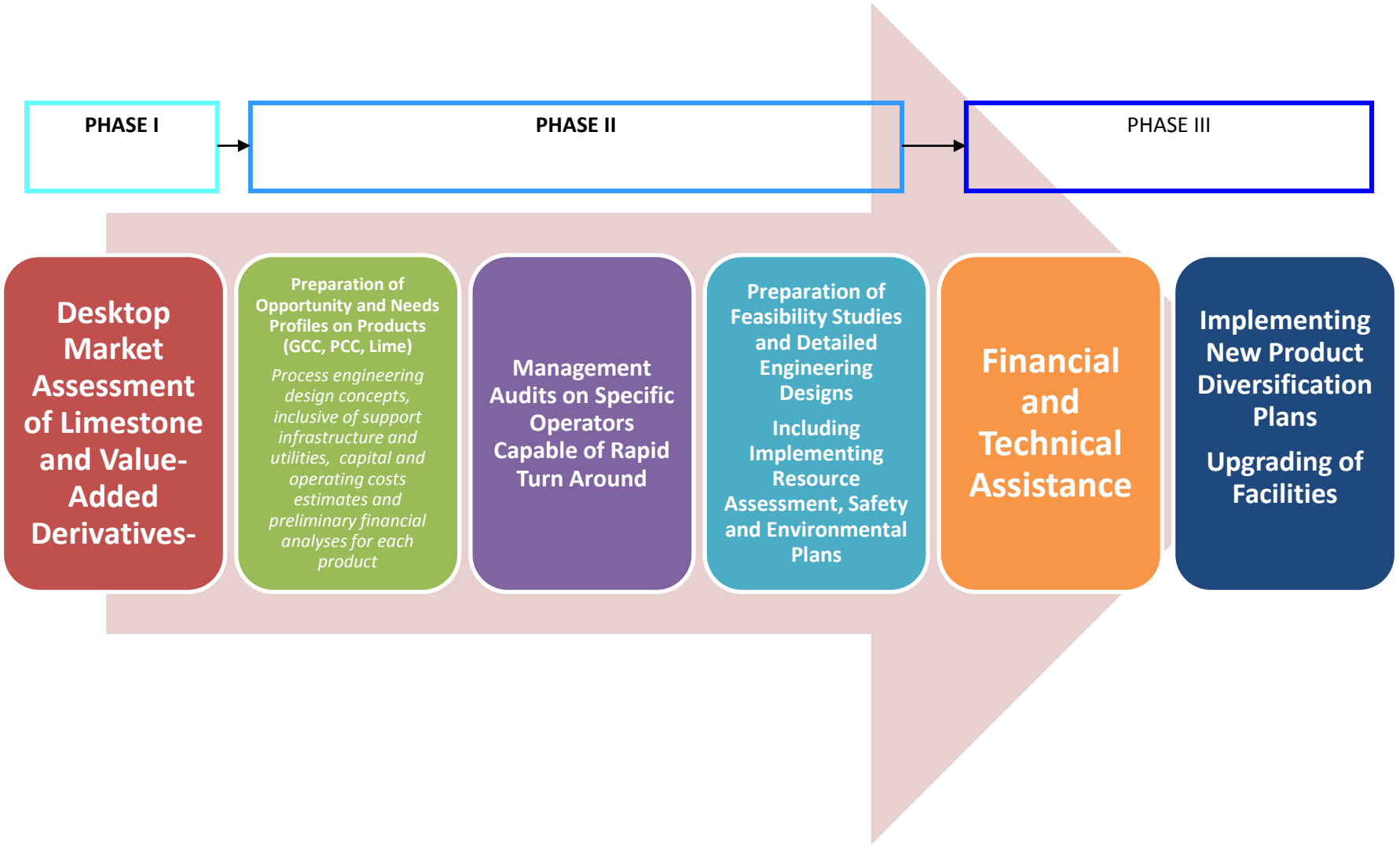
THE WAY FORWARD

- Production of table tops from composites of recrystallized limestone
- Using softer limestone for cladding purposes
- Research & Development and Innovation must be applied to mainstream the high value added products into economy
- Increase output into housing
  - Flexible PVC
    - Cables
    - Flooring (leather cloth, wall coverings, tarpaulin and automotive underbody sealing.)
  - Pipes and Profiles
    - PVC Pressure pipes
    - PVC foam core pipes
    - PVC sewerage pipes and fittings
    - Profiles (windows etc)
    - Electrical conduits

THE WAY FORWARD

- High value added alabaster
- Clays
- Re-crystallized limestone lends itself to the development of the used of glazes
- Import substitution
- Production of anti-fungal paint
- Reduced Energy cost and improved prospect for ceramic industry
- Bring elicit quarrying under control
- Database management is critically important
- Quality standards must be carried out throughout the industry
- Port utilization
- Scope for increased use of existing ports – at present below 62% capacity utilization
- Policy development
- Facilities on south coast need new bulk shipping port
- Protected areas status of Negril Protected Area
- Revisit zoning with environmental regulatory agencies
- Energy – Non-renewables and renewables

THE WAY FORWARD



Order of Magnitude Profitability

- Estimated Return on Investment (ROI), based on previous studies:
  - Limestone Aggregate – 17%
  - Ground Calcium Carbonate (GCC) – 660%
  - Marble – 90%
  - Quicklime – 89%
  - Hydrated Lime – 144%
  - Precipitated Calcium Carbonate (PCC) – 80%
  - Calcium Carbide (CaC_2)

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THANK YOU