Limestone Investment Opportunities in Jamaica: Highlights from the Limestone Value Chain Analysis

June 24 2020

pwc

Objectives

The objectives of this session include:

1. Understand the current-state of the global limestone industry.
2. Recognise how global drivers and trends are applicable to the Jamaican context.
3. Learn about the results of the work which was done under the Limestone Value Chain Consultancy.
4. Discuss value-added products that can provide additional income generation and available tools.
5. Provide an opportunity for dialogue and idea exchange among operators and other key stakeholders.

The state of the global limestone industry

The global trade flow of limestone is led by Asia however the Americas region presents a sizable limestone market which is projected to grow by over 13% in volume by 2024.

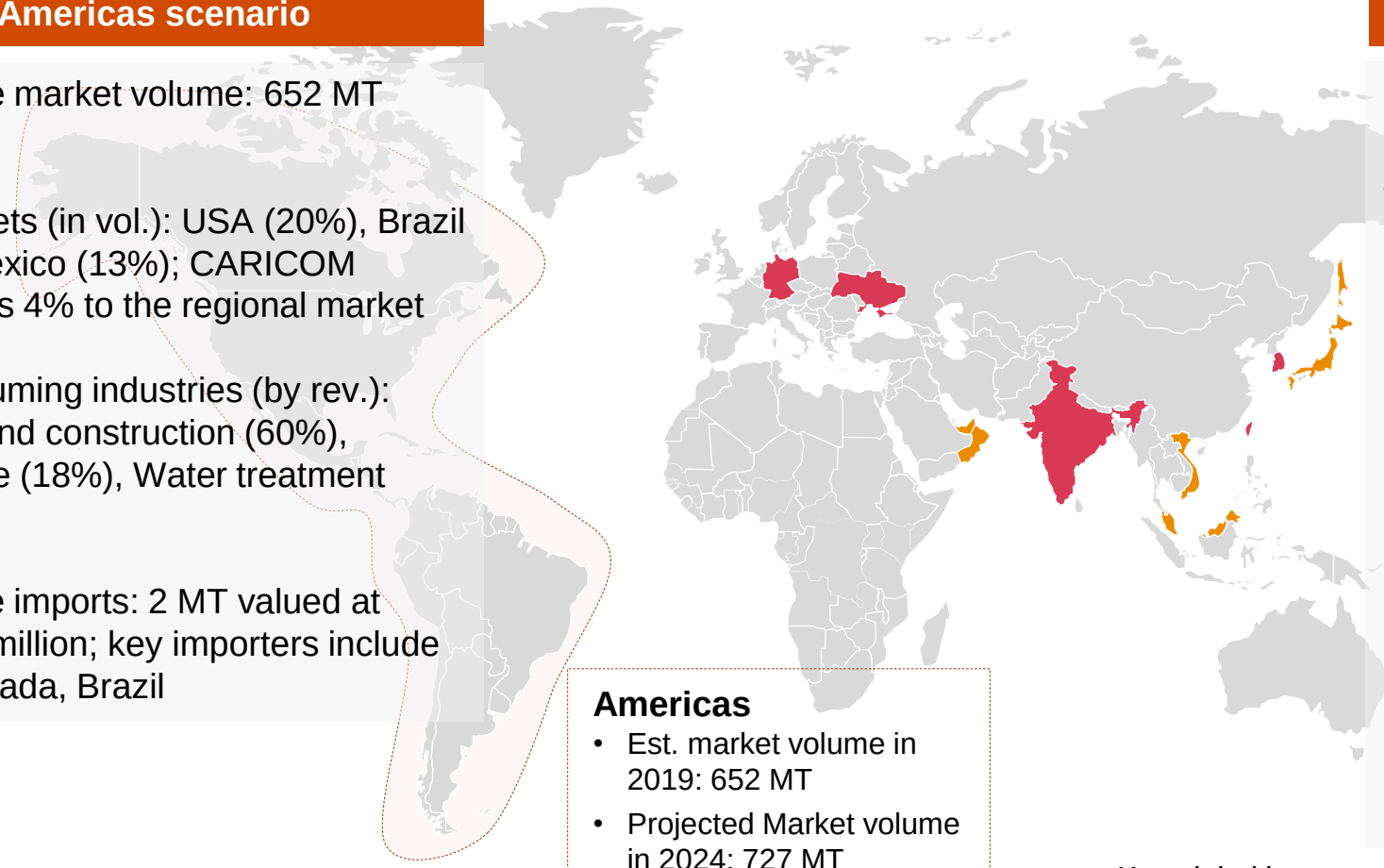
Americas scenario

Limestone market volume: 652 MT (2019)

Key markets (in vol.): USA (20%), Brazil (21%), Mexico (13%); CARICOM contributes 4% to the regional market

Key consuming industries (by rev.): Building and construction (60%), Agriculture (18%), Water treatment (8%)

Limestone imports: 2 MT valued at US$32.4 million; key importers include USA, Canada, Brazil



Global scenario

Global imports**:** about US$1 billion (2019); of which 3% was contributed by the Americas region

Global trade flow is largely driven by Asian countries

Largest importers (US$ million) : India (482); Taiwan (62); South Korea (49); Germany (43); Japan (42)

Largest exporters (US$ million): UAE (379); Vietnam (114); India (63); Oman (58); Japan (57)

Trade flow is mainly to nearby markets e.g. UAE exports to nearby markets like India, Kuwait

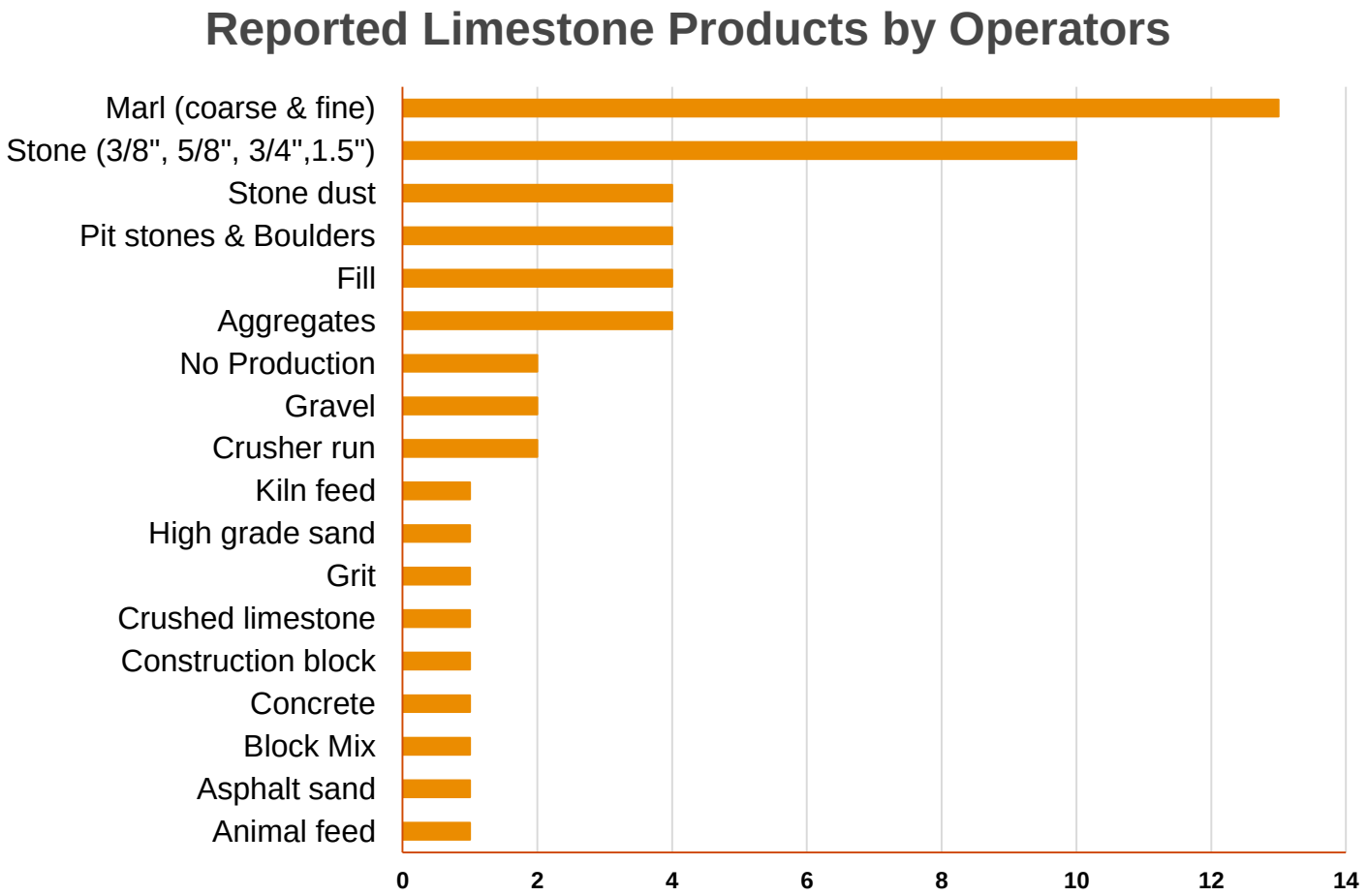
Source: ITC Trademap accessed on 8th May 2020, Mordor Intelligence, PwC Analysis

Current limestone products by Jamaican operators

The majority of operators are developing products, however they are products at the lower end of the value chain. Opportunity exists to move to the higher end of the value chain given the grade of limestone in Jamaica.

Items produced in Jamaica

- The value for minerals in Jamaica is largely driven by local competition (volumes) rather than quality.
- Currently, most quarry operators produce marl and stone which are considered low value-added products. These are ground limestone of various sizes and require little modification.
- A subset of operators are currently exporting (3-4 operators).



Source: Operator survey, site visits, MGD

Summary of the competitive position of Jamaica's limestone industry

A review of the competitiveness of the industry is key to taking advantage of opportunities and strengths and creating a competitive advantage.

Strengths

The below lists items with which Jamaica naturally has an advantage in without requiring additional steps to be taken:

- Large mineable reserve of high purity limestone
- Large customer base for end product
- Central Location of country in relation to North and South America

Opportunities

The below lists items that are possible options through which the limestone industry in Jamaica can be improved:

- Development of SEZs
- Updates in regulations
- Production of value-added products
- Financial arrangements through investment stakeholders
- Technology transfer partnerships

Limestone value-added products

Market demand, capability of operators and financial feasibility were considered to determine the selection of six limestone value-added products.

Through consultation with JAMPRO, MGD, and other stakeholders, the following seven (7) products were shortlisted.

Products	End-use Industries		
Ground Calcium Carbonate	• Agriculture (fertilisers) • Animal pets and feeds • Paper	• Plastics • Paints and surface coatings	• Rubber and elastomers • Food, Pharmaceuticals and Household
Precipitated Calcium Carbonate	• Food & Pharmaceuticals • Paper and Pulp	• Plastic • Paint	• Agriculture and Animal feed • Rubber
Quicklime, Slaked Lime & Hydraulic Lime*	• Iron & Steel • Food • Construction and buildings	• Paper and pulp • Environment	• Agriculture
Dimension Stone	• Building Construction	• Decoration	• Tiles
Cultured Marble	• Kitchen Fixtures (countertops, backsplashes and wall panels)	• Home Decor	• Bathroom Fixtures (bathtubs, sinks, countertops, wall panels, shower walls and shower pans)

*Given the similarities, it was determined these three products were to be combined into a single investment package.

Major importing markets for limestone value-added products

The market for limestone value-added products is robust including in the Americas

Product & HS Code used	Key Importing Markets, 2019 (in US$ thousand)						Jamaica's trade balance 2019 (in US$ thousand)
	World	Asia	Europe	Africa	Americas	CARICOM	
Calcium Carbonate (GCC & PCC) HS Code: 283650	***844,814***	331,426	333,085	83,771	87,525	2,301	-316
Quicklime HS Code: 252210	**818,523**	168,238	355,486	99,225	160,359	310	-22
Slaked Lime HS Code: **252230**	**186,236**	41,795	80,235	31,426	29,677	587	-
Hydraulic Lime HS Code: 252210	**32,708**	3,299	19,607	7,951	1,539	277	-
Calcareous Stone HS Code: 680229, 680292	**580,092**	125,480	220,101	10,319	195,499	*1,735*	-25
Ceramic kitchen and bathroom products* HS Code: 6910	**7,462,981**	2,359,778	2,526,043	437,212	1,970,375	21,081	-5,336

Nearby market opportunity for limestone value-added products

Source: ITC Trade map accessed on 7th May 2020
PwC

*Taken as a reference/substitute for Cultured Marble product

Nearby market demand

Demand exists within the region for limestone value-added products.

Kitchen imports from Mexico, Canada & USA contribute almost 90% of total imports in studied markets.

- The table to the right showcases the import value of selected countries in thousands of US$ based on proximity to Jamaica.
- Opportunities of unexplored export options are present for the shortlisted value-added limestone products.

Central position within Caribbean makes for ideal export to CARICOM nations.

Consolidated import values in select countries in 2019, in '000 US$

Markets	GCC/ PCC	Quicklime	Slaked Lime	Hydraulic Lime	Dimension Stone	Kitchen and Bathroom Products[1]	Aggregate & Stones[2]
USA	29,210	39,779	14,473	740	148,498	1,387,507	12,752
Canada	15,013	38,233	5,442	437	31,394	220,787	9,567
Mexico	1,293	178	-	-	4,095	57,749	-
Brazil	7,891	16,280	461	-	2,029	8,709	8,030
Chile	6,706	58,220	2,311	25	202	33,972	167
CARICOM	2,301	310	587	277	1,735	21,081	874
Total imports in the countries studied	62,414	153,000	23,274	1,479	187,692	1,729,805	31,390
Jamaica's exports[3]	43	-	-	-	-	-	3,787

Source: ITC Trademap accessed on 7th May 2020, ITC; PwC Analysis

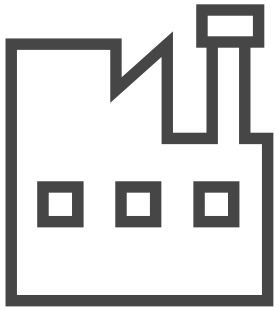
1: Ceramic products used to assess market of Cultured Marble product
2: Limestone used in manufacture of lime and cement
3. Exports data is from 2018 which is the most complete year at time of writing

Determining value-added product feasibility

Feasibility and investment appraisal techniques were used for two scenarios.

Standalone Implementation

This assumes that investor does not have an existing operational mining / quarry operation and will be making an incremental investment in value-added products. That is, operations will be started from scratch.



Incremental Implementation

This assumes that the investor already has an existing operational mining / quarry operation and will be making an incremental investment in value-added products. That is, operations will not be started from scratch.

Value-added product - Ground Calcium Carbonate (GCC)

Production Process

GCC is produced by mechanical grinding of mined limestone with no change in its chemical composition. The key processes involved are: -

- High purity limestone from mines are transported to the GCC plant
- The raw feed is crushed using two-stage crushing system through jaw and hammer crusher wherein the feed size is decreased to 5-20 mm, suitable for grinding
- The output from crushing plant is fed to the grinding mill which produces fine powder of 10- 15 microns
- Post grinding the product is stored, packaged and transported to customers.

Ground Calcium Carbonate

End Use Industries

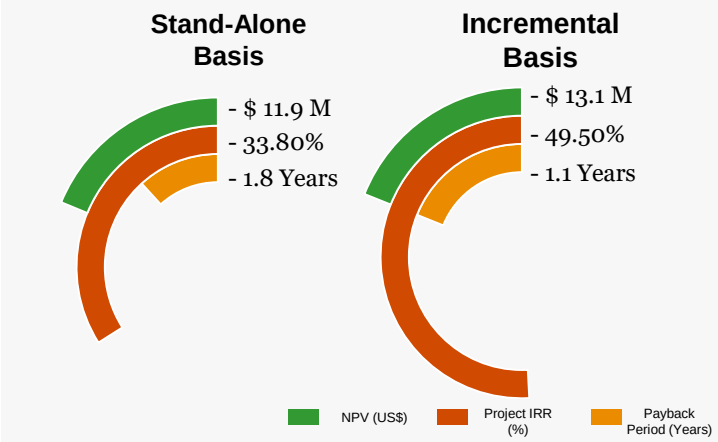
- Agriculture (fertilisers)
- Animal pets and feeds
- Paper
- Plastics
- Paints and surface coatings
- Rubber and elastomers
- Food, Pharmaceuticals and Household

Table showing GCC standalone and incremental capital cost break down

Description	Standalone Capital Cost (US$ millions)	Incremental Capital Cost (US$ millions)
Land cost	0.39	0.08
Equipment cost (truck, wheel loader, etc.)	0.64	0.50
Processing set-up cost	1.00	1.00
Power cost	0.68	-
Infrastructure cost	0.10	0.07
Laboratory set-up cost	0.43	0.43
Contingency @5%	0.17	0.10
Total Estimated Capital Expenditure	**3.41**	**2.18**

Table showing GCC NPV, IRR and payback period

Scenario	NPV	IRR	Payback Period
Stand-Alone Basis	US$11.9M	33.80%	1.8 years
Incremental basis	US$13.1M	49.50%	1.1 years



Markets	USA	Canada	Mexico	Brazil	Chile	CARICOM	Total imports in the region studied	Jamaica's exports
GCC/PCC	29,210	15,013	1,293	7,891	6,706	2,301	62,414	23

Value-added product - Precipitated Calcium Carbonate (PCC)

Production Process

PCC is a synthetic compound made by hydrating high-calcium Quicklime and then reacting the resulting slurry with carbon dioxide. The key processes involved are: -

- High purity limestone from mines are transported to the PCC plant
- A two-stage crushing system consisting of jaw and hammer crusher is used to reduce the size of feed suitable for input to the lime kiln system.
- The crushed limestone is calcined in a kiln at about 1000°C which takes the calcium carbonate apart, forming quicklime and carbon dioxide gas.
- After calcination, water is added to the lime in a hydrator to form calcium hydroxide (Slaked/Hydrated lime).
- Carbon dioxide is then reacted with the Slaked Lime to produce calcium carbonate, and since it is insoluble in water, precipitates out.
- The PCC/calcium carbonate produced is then deagglomerated, filtered and dried after which the dried powder is packaged and stored or transported to customers.

Table showing PCC standalone and incremental capital cost break down

Description	Standalone Capital Cost (US$ millions)	Incremental Capital Cost (US$ millions)
Land cost	0.39	0.08
Equipment cost (truck, wheel loader, etc.)	0.64	0.50
Processing set-up cost	2.72	2.72
Power cost	0.68	-
Infrastructure cost	0.10	0.07
Laboratory set-up cost	0.43	0.43
Contingency @5%	0.25	0.19
Total Estimated Capital Expenditure	**5.21**	**3.99**

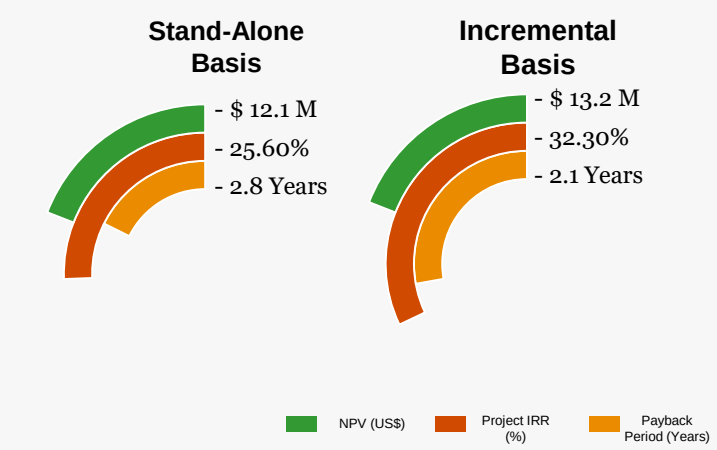
Precipitated Calcium Carbonate

End Use Industries

- Agriculture (fertilisers)
- Animal and pet feeds
- Paper
- Plastic
- Paints and surface coatings
- Rubber and elastomers
- Food, Pharmaceuticals and Household
- Toothpaste
- Buildings and construction

Table showing PCC NPV, IRR and payback period

Scenario	NPV	IRR	Payback Period
Stand-Alone Basis	US$12.1M	25.60%	2.8 years
Incremental Basis	US$13.2M	32.30%	2.1 years



Markets	USA	Canada	Mexico	Brazil	Chile	CARICOM	Total imports in the region studied	Jamaica's exports
GCC/PCC	29,210	15,013	1,293	7,891	6,706	2,301	62,414	23

Value-added product - Quicklime, Slaked Lime & Hydraulic Lime

Production Process

Quicklime and Slaked Lime (Hydrated Lime) have similar production lines hence they are considered in a single investment package. The production process of both Hydraulic Lime and Slaked Lime contains common steps such as crushing, calcination, cooling, slaking of lime and finally packaging & dispatch. The key processes involved are: -

- High purity limestone from mines are transported to the quicklime and slaked lime plant
- A two-stage crushing system consisting of jaw and hammer crusher is used to reduce the size of feed suitable for input to the lime kiln system.
- The crushed limestone is calcined in a kiln at about 1000°C which takes the calcium carbonate apart, forming Quicklime and carbon dioxide gas.
- Quicklime is taken to a hydrator where precise volume of water is added to the Quicklime to produce Calcium Hydroxide or Slaked lime.

Quicklime

Slaked Lime

Hydraulic Lime

End Use Industries

Quicklime and Slaked Lime

- Iron & Steel
- Food
- Paper and pulp
- Environment
- Buildings and construction
- Agriculture

Hydraulic Lime

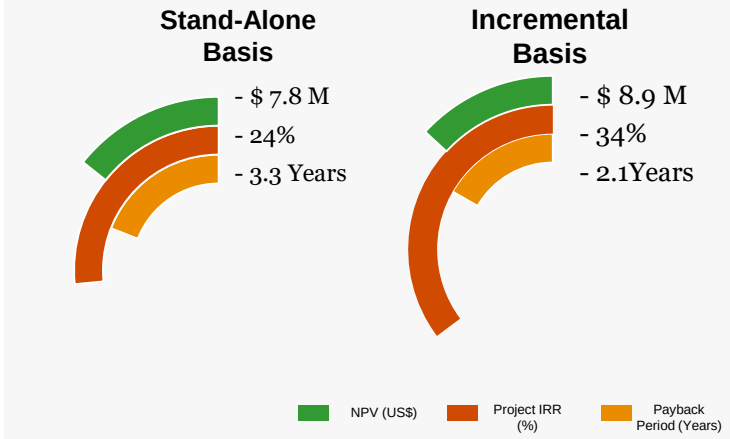
- Construction

Table showing Quicklime, Slaked Lime & Hydraulic Lime standalone and incremental capital cost break down

Description	Standalone Capital Cost (US$ millions)	Incremental Capital Cost (US$ millions)
Land cost	0.39	0.08
Equipment cost (truck, wheel loader, etc.)	0.64	0.50
Processing set-up cost	1.21	1.21
Power cost	0.68	-
Infrastructure cost	0.10	0.07
Laboratory set-up cost	0.43	0.43
Contingency @5%	0.17	0.11
Total Estimated Capital Expenditure	3.62	2.40

Table showing Quicklime, Slaked Lime & Hydraulic Lime NPV, IRR and payback period

Scenario	NPV	IRR	Payback Period
Stand-Alone Basis	US$7.8M	24%	3.3 years
Incremental Basis	US$8.9M	34%	2.1 years



Markets	USA	Canada	Mexico	Brazil	Chile	CARICOM	Total imports in the region studied	Jamaica's exports
Quicklime	39,779	38,233	178	16,280	58,220	310	153,000	-
Slaked Lime	14,473	5,442	-	461	2,311	587	23,247	-
Hydraulic Lime	740	437	-	-	25	277	1,479	-

Value-added product - Dimension Stone

Production Process

Dimension Stone is natural stone or rock that has been selected, cut and finished depending on its application. The key processes involved are: -

- Formation of operational benches in mine by removal of overburden
- Removal of blocks from the operational benches by using block extraction methods such as wire sawing or drilling and blasting or cutting
- The blocks are then transported to the processing plant where it is processed as per final product requirement
- The blocks are cut by multiple wire saws and multi-blade cutting machines per the requirement
- The cut blocks are further trimmed, polished, honed and bush hammered to produce the final product.
- The final product is dispatched in special trailer trucks to resist breakage or fractures

Dimension Stone

End Use Industries

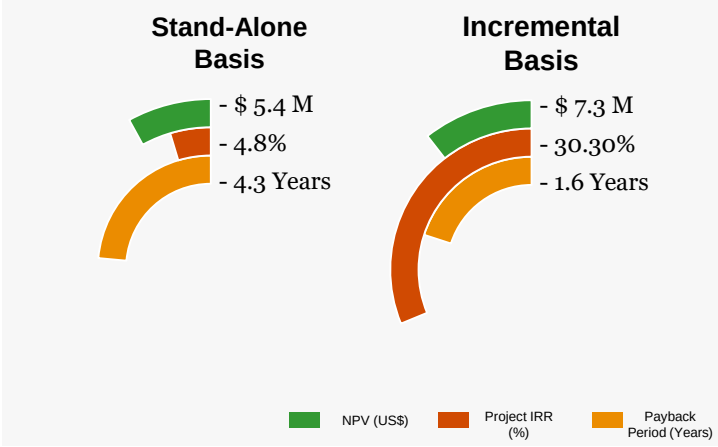
- Building Construction
- Decoration
- Tiles

Table showing Dimension Stone standalone and incremental capital cost break down

Description	Standalone Capital Cost (US$ millions)	Incremental Capital Cost (US$ millions)
Land cost	0.54	0.11
Equipment cost (truck, wheel loader, etc.)	1.45	0.62
Processing set-up cost	0.65	0.44
Power cost	0.24	0.24
Infrastructure cost	0.32	-
Laboratory set-up cost	0.18	0.18
Contingency @5%	0.17	0.08
Total Estimated Capital Expenditure	**3.55**	**1.67**

Table showing Dimension Stone NPV, IRR and payback period

Scenario	NPV	IRR	Payback Period
Stand-Alone Basis	US$5.4M	4.8%	4.3 years
Incremental Basis	US$7.3M	30.30%	1.6 years



Markets	USA	Canada	Mexico	Brazil	Chile	CARICOM	Total imports in the region studied	Jamaica's exports
Dimension Stone	148,498	31,394	4,095	2,029	500	1,474	187,990	-

Value-added product - Cultured Marble

Production Process

Cultured marble is a blend of stone particles and resins that is combined with pigments to produce a wide range of colors and realistic, natural looking patterns. The key processes involved are: -

- Gel coating, a type of polyester, is sprayed using a spray gun on the casting mould. The mould defines the shape of the final product.
- Casting resin, which is a mixture of polymer, reactive monomer, promoter, inhibitors and special additives, is blended with calcium carbonate fillers to make a matrix.
- The matrix is poured on to the mould placed on a vibrating table to ensure evenness of the flow
- The mould is then left to cure in a storage area.
- Post curing, de-moulding is done and the product is processed for the desired aesthetic look through trimming, sanding and polishing.
- The final product is packaged and transported to the market/customer.

Table showing Cultured Marble standalone and incremental capital cost break down

Description	Standalone Capital Cost (US$ millions)	Incremental Capital Cost (US$ millions)
Land cost	0.01	0.01
Equipment cost (truck, wheel loader, etc.)	0.48	0.32
Processing set-up cost	0.40	0.40
Power cost	0.16	-
Infrastructure cost	0.34	0.22
Contingency @5%	0.07	0.05
Total Estimated Capital Expenditure	**1.47**	**1.00**

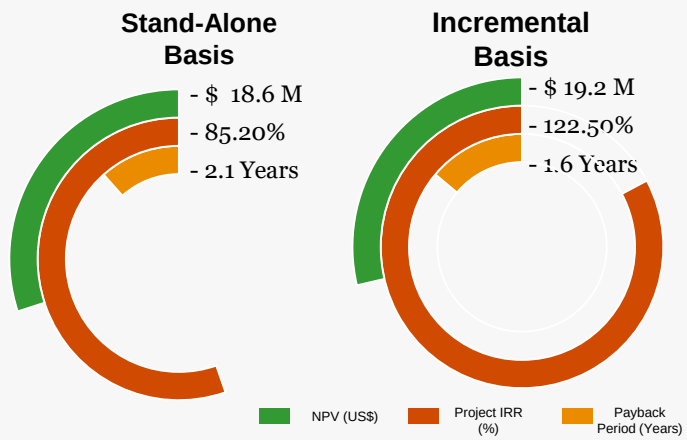
Cultured Marble

End Use Industries

- Kitchen fixtures
- Bath fixtures
- Household accessories

Table showing Cultured Marble NPV, IRR and payback period

Scenario	NPV	IRR	Payback Period
Stand-Alone Basis	US$18.6M	85.20%	2.1 year
Incremental Basis	US$19.2M	122.50%	1.6 year



Markets	USA	Canada	Mexico	Brazil	Chile	CARICOM	Total imports in the region studied	Jamaica's exports
Kitchen and Bathroom Products[1]	1,387,507	220,787	57,749	8,709	33,972	21,081	1,729,805	1

1: Ceramic products used to assess market of Cultured Marble product

Summary

The below provides key points of note, next steps and more information.

Growth Opportunities

Limestone value-added products are projected to grow:

- Americas import market of nearly $500M USD
- Project CAGR increase of 13% by 2024
- Key markets – USA, Canada, Brazil, Chile

Value-added products

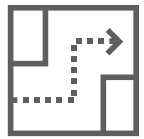
Value-added products that viable investments:

- GCC
- PCC
- Quicklime, Slaked Lime & Hydraulic Lime
- Dimension Stone
- Cultured Marble

Entities that can assist

For more information on the information which was presented today, contact the following organisations:

- JAMPRO Trade & Investment Jamaica
- Development Bank of Jamaica Limited



Next Steps

Packages will be distributed by JAMPRO, for more information see: https://dobusinessjamaica.com/

Let's Do Business Jamaica!

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