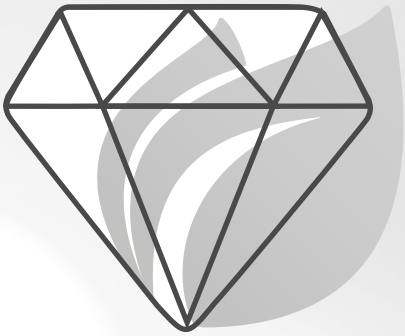
PHD CHAMBER

PROGRESS HARMONY DEVELOPMENT

Estd. - 1905

Grown Diamonds, A Sunrise Industry in India: Prospects for Economic Growth



November 2015

PHD CHAMBER OF COMMERCE AND INDUSTRY

PHD House, 4/2 Siri Institutional Area, August Kranti Marg, New Delhi - 110016
Phone: 91-11-49545454; Fax: 91-11-26855450, 26863135
Email: research@phdcci.in Website: www.phdcci.in

Preface

Shri Saurabh Sanyal
Secretary General

For centuries, man has had to excavate tonnes and tonnes of earth to find diamonds. However, technological advancements have enabled growing beautiful and exceptional quality diamonds above the earth in diamond growing greenhouses through the same natural crystallization process which creates mined diamonds under the earth. These diamonds are rightly named as 'Grown Diamonds.'

Grown Diamonds are seen as a sustainable and pertinent source of diamonds since rough mined supply which is projected to decline from the current level of 125 million carats to only 14 million carats in 2050. However, demand for rough diamonds is poised to rise to 292 million carats.

Grown diamonds carrying properties, features and applications identical to earth-mined diamonds appear to be the best supplementary source for diamonds to take the domestic diamond processing industry meet the several economic, commercial and social aspirations of the country. However, grown diamonds are considered as 'Synthetic' in the country majorly because of being identified under HS Code 7104 which is for 'Synthetic Stones'.

At this backdrop, it is imperative for the government to review the HS Code classification for Grown Diamonds which carries immense value for the growth of the economy, going forward.

I commend and appreciate the tireless efforts of PHD Research Bureau led by Dr. S P Sharma, Chief Economist and Ms. Rashmi Taneja, Senior Research Officer, PHD Chamber for producing this study to bring this new innovative diamond source, 'Grown Diamonds' into consideration of all the stakeholders of the economy.

Acknowledgements

Dr. S P Sharma
Chief Economist

Grown diamonds are one of the most promising developments in diamond industry because of being identical to earth-mined diamonds and are gradually gaining acceptance across various segments of the society due to its several benefits viz. employment generation, growth of ancillary industries and earning foreign exchange.

PHD Research Bureau of PHD Chamber has undertaken a study 'Grown Diamonds, A Sunrise Industry in India: Prospects for Economic Growth' which pertains to highlight prospects of grown diamonds as a Sunrise Industry in India. Few concerns and suggestions are also provided so that the government can accordingly undertake supportive measures to welcome grown diamonds in the best possible way.

We take this opportunity to express our gratitude and respect to our office bearers Shri Alok B Shriram, President, Shri Mahesh Gupta, Senior Vice President and Shri Gopal Jiwarajika, Vice President for their continuous support.

We express our sincere thanks to all the experts from the grown diamond industry and other stakeholders for providing their valuable inputs and deep insights while conducting the study.
Last but not the least, we would also like to place on record the support and services of Mr. Hariom Kuthwaria, Graphic Designer, PHD Chamber.

Contents

S.No.	Content	Page No.
1.	Executive Summary	01
2.	Grown Diamonds: A Magnificent Development in Diamond Industry	03
3.	Mined Diamonds & Grown Diamonds: A Comparison	10
4.	Where is the Global Diamond Industry Headed?	15
5.	A 'Realistic' View of the Indian Diamond Industry	18
6.	Impact Analysis of Grown Diamond Processing in India	22
7.	Grown Diamonds, A Sunrise Industry: Concerns and Suggestions	28
8.	Conclusions	32

Tables & Figures

S.No.	Contents	Page No.
Table 1:	Comparison of Physical Properties of Diamonds - Grown, Earth Mined and Simulants	12
Table 2:	Comparison of Basic Facts: Grown Diamonds vis-à-vis Earth Mined Diamonds	12 13
Table 3:	Chemical Composition of Grown vis-à-vis Earth Mined Diamonds	14
Table 4:	Chemical Composition and Formation Process of Diamonds and Simulants	20
Figure 1:	Countrywise % Share Diamond Production by Volume (carats) - 2014	16
Figure 2:	Annual Global Diamonds Production (Million Carats)	17
Figure 3:	Demand Supply Gap	17
Figure 4:	Countrywise Diamond Imports by Volume (carats)	19
Figure 5:	Countrywise Diamond Exports by Volume (carats)	19
Table 5:	% Share of Cut & Polished Diamonds Exports in India	20
Table 6:	Suggested HS Code Classification for Grown vis-à-vis Mined Diamonds	30
Table 7:	Existing HS Code Classification for Natural Pearls and Cultured Pearls	31

Exhibits

S.No.	Contents	Page No.
Exhibit 1:	Grown & Mined Diamonds	05
Exhibit 2:	Key Techniques for Growing Diamonds	07
Exhibit 3:	Process of Growing Diamonds	07
Exhibit 4:	Incredible Journey of Diamonds	09
Exhibit 5:	Adding Value to Indian Exports	24
Exhibit 6:	DÉJA VU - Depleting Supply of Natural Pearls led to Birth of cultured Pearl Industry	26

Executive Summary

The grown diamond industry is seen as a 'Sunrise Industry' for the global economy and especially for an economy like India which derives livelihood of millions of people and foreign exchange from the diamond industry.

This innovative product is seen as a sustainable and pertinent source of diamonds for the future in the light of the projections for rough mined diamond supply which is set to decline from the current level of 125 million carats to only 14 million carats in 2050, whereas demand for rough diamonds will rise to 292 million carats.

At this juncture it is imperative for India to look for the best supplementary source of rough diamonds which at present is 'Grown Diamonds' because of its identical physical, chemical and optical properties to the mined diamonds. Furthermore, projections of rising production capacity for grown diamonds (including gem and non-gem application) exponentially for next 10-15 years from the present scale (2014) of around 360,000 carats to 2 million carats by 2018 and to 20 million carats by 2026 also provide a substantial base to accept grown diamonds as an important source of rough diamonds for the Indian Cutting & Polishing industry.

However, grown diamonds despite being identical to mined diamonds and carrying huge commercial potential are facing few concerns in India. One, real facts about grown diamonds are not recognized and placed well in the Indian diamond industry. Despite having physical, chemical and optical properties identical to mined diamonds; the grown diamonds are usually perceived as 'synthetic' which creates wrong perception amongst customers as well as accrues an inferior commercial value for the traders.

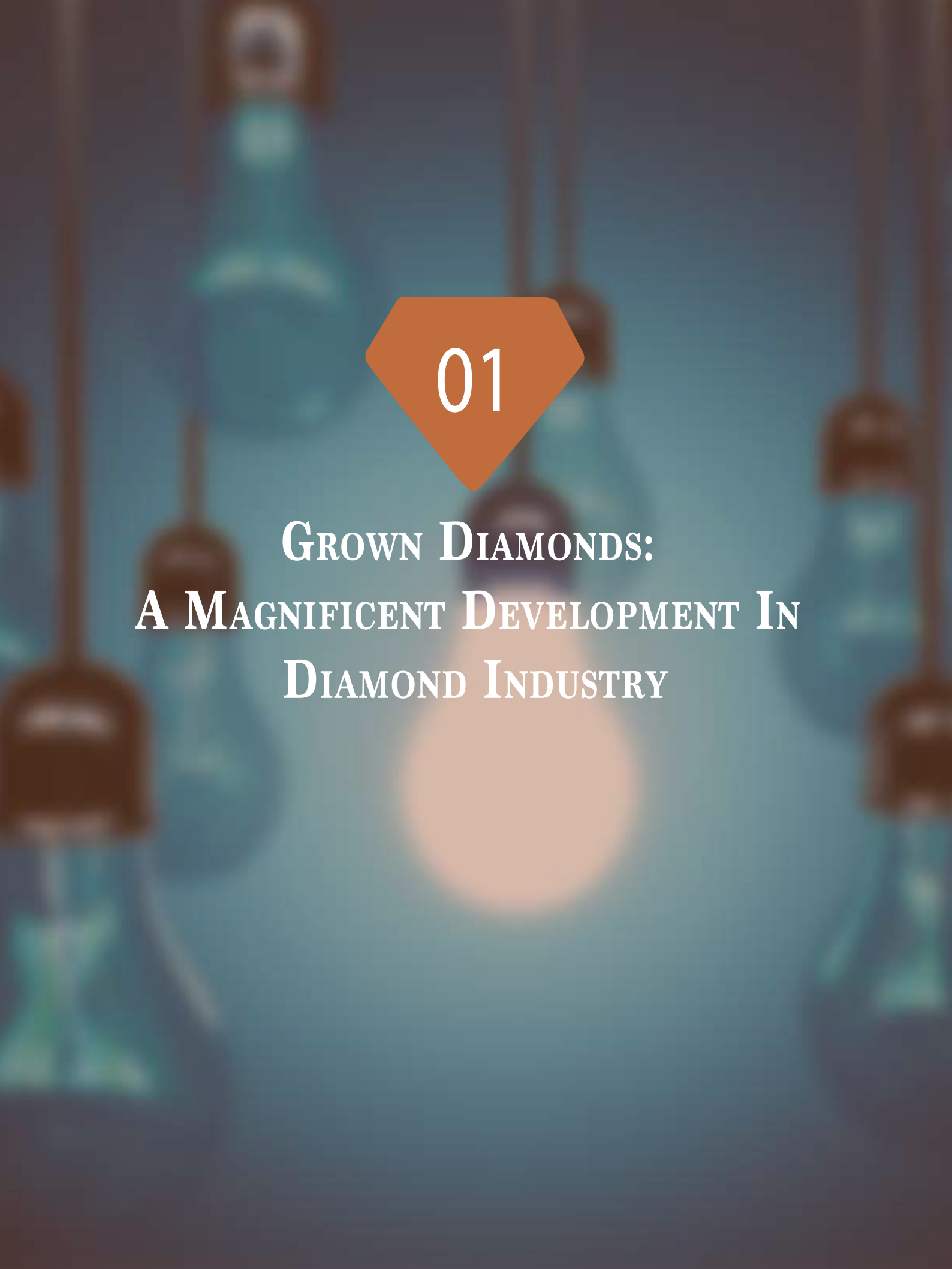
The other concern is that people are not aware about the availability of this new choice in diamonds which is identical to mined diamonds. These concerns, which are associated with the grown diamonds in the country, if timely and effectively addressed by the Government will be a win-win situation for various segments of the economy viz. Industry, Government , Customers and Society as a whole.

Grown Diamonds are REAL diamonds purely made up of carbon and are suggested to be covered through the same HS code which covers Mined Diamonds i.e. 7102 under a unique sub-category at the 6th and 8th digit level. In order to differentiate the point of origin, maintain the same Heading Code (first four digits - 7102) for both mined as well as grown diamonds with different four digits at the end. The proper classification of grown diamonds within HS code of diamonds would enable the miners/traders to switch over to the trading of grown diamonds and to gain customers confidence in the purity and genuineness of the grown diamonds.

[1] *Grown Diamonds : Unlocking Future of Diamond Industry by 2050, Frost & Sullivan Report, December 2014*

The study also suggests that it is imperative to create awareness about the grown diamonds at both retail and trade level. For this, the government first, recognizes the long-term growth prospects of grown diamonds; second, re-classify the grown diamonds under the category of diamonds and third, grown diamonds should be promoted through exclusive trade shows and exhibitions. This will enable people to understand technical aspects of the grown diamonds so as to avoid usage of terms like 'synthetic' or 'artificial diamonds' that are often connected with the product.

We are hopeful that by handholding the grown diamonds as a 'Sunrise Industry' in India through its appropriate classification of HS code and effective promotional measures; all the stakeholders of the diamond industry and the entire society will be able to avail its various benefits and propel the economy's growth, going ahead.



01

Grown Diamonds: A Magnificent Development In Diamond Industry

1. Grown Diamonds: A Magnificent Development In Diamond Industry

For centuries, man has had to excavate tonnes of earth to find diamonds. However, technological advancements have enabled growing beautiful and exceptional quality diamonds above earth through the same natural crystallization process which create mined diamonds under the earth. Enabling diamond-growing conditions in a semiconductor grade facility inside a Diamond Growing Greenhouse[1] above earth's surface, results in diamonds that have essentially the same physical, chemical and optical properties as diamonds from the mines and the diamond is rightly named as 'Grown Diamond'.

Since, mined diamonds are a finite resource, newer diamond resources - the grown diamonds are being hailed as one of the most promising technical developments of the 21st century, one that would change the face of the industry for better and perhaps forever.

> ***Mined Diamonds*** *grow inside earth through geological processes from a carbon source and are extracted by excavating several tonnes of earth.*
>
> ***Grown Diamonds*** *grow through the same natural crystallization process as mined diamonds and share the same physical, chemical and optical properties.*

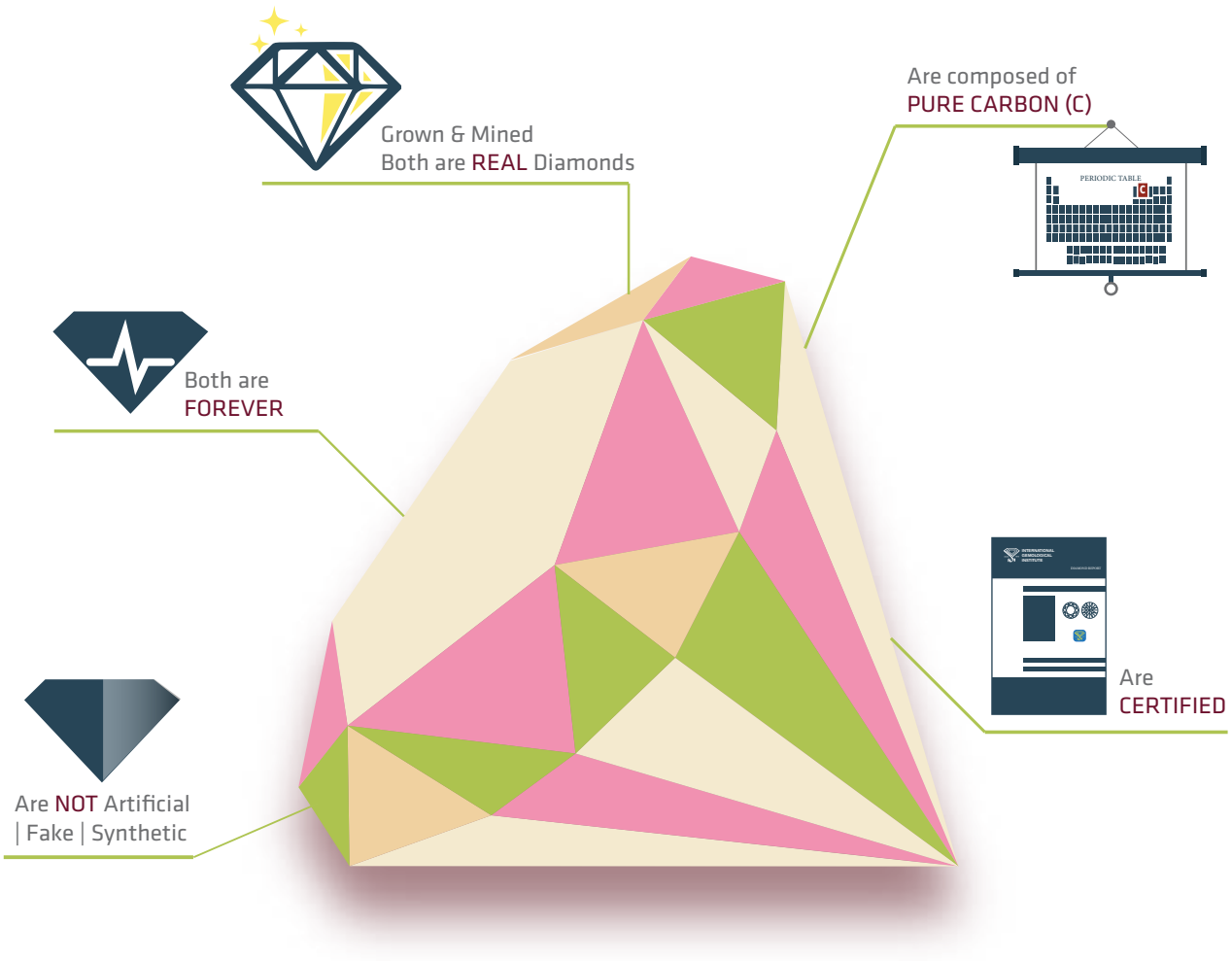
Technological developments have enabled manufacturers to produce grown diamonds which have presented the industry with a significant growth opportunity, with a noticeable influence on the economy and the diamond value chain, as researchers predict the demand for grown diamonds to double in the next ten years. For nearly seven decades, diamonds have been cultured in laboratories by scientists with the intention to explore diamond's various characteristics that can significantly improve human life. As technology improved, higher quality of diamonds were cultivated by researchers and made available for several new commercial applications during the last decade. Diamond is not only the hardest material on earth but also has various other super material-like characteristics that make it ideal for electronics, optical or mechanical components, and precision engineering applications besides gems & jewellery.

Currently, high quality grown diamonds are produced by a handful of companies worldwide. Taking the demand and supply side factors into account, Frost & Sullivan's research estimates 1.9% of total global polished diamonds sales revenue will come from grown polished diamonds by 2018.[2] Scientists, today accept that diamonds from greenhouses and diamonds from mines are identical products with different origins. Just as it is impossible to differentiate between flowers from a greenhouse and those from native territory, grown diamonds too are indistinguishable from mined diamonds to the naked eye. Cultured above earth as a result of natural growth of a diamond seed into a rough diamond (under conditions identical to geological conditions), Grown Diamonds and Earth Mined Diamonds are composed of pure carbon with identical atomic structure and chemical bonding.

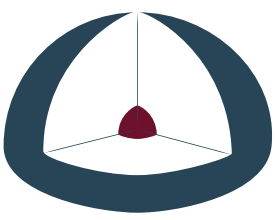
[1] *A machine that uses Microwave Plasma Chemical Vapour Deposition (MPCVD) technique to grow Type IIa Diamonds, the purest form of diamond*
[2] *The Diamond Growing Greenhouses, Grown Diamonds in the Gems & Jewellery Industry, Frost & Sullivan Report, March 2014*

Grown & Mined Diamonds

Identical product

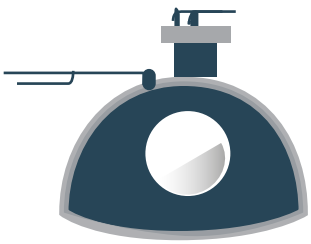


But different Origin



EARTH

Natural crystallisation process



GREENHOUSE

Compiled by: PHD Bureau

Exhibit 1

1.1 GROWN DIAMONDS ARE 'REAL' DIAMONDS

The process of growing a diamond is similar to growing a flower in a greenhouse, as opposed to a flower growing in the wild (which is comparable to Mined Diamonds). Grown diamonds have physical, chemical and optical properties identical to Earth-Mined Diamonds and thus, there is no difference between grown and mined diamonds except for where they are grown. (Refer Exhibit 1).

1.2 HOW DIAMONDS ARE GROWN

Diamond is a superior material for many purposes due to its hardness, optical clarity, and resistance to chemicals, radiation, and electrical fields. Earth-mined diamonds are constrained by limited supply, rigorous and time-consuming formation process. As diamond growing technologies continue to evolve, the larger jewellery industry, commercial sector & the research community – for the first time – doesn't have to only on depend on mined diamond resources.[3] Different techniques of growing high quality diamonds are discussed here below.
(Refer Exhibit 2,3)

1.2.1 HIGH PRESSURE-HIGH TEMPERATURE (HPHT) TECHNIQUE

In the HPHT technique, diamonds are formed in a growth environment by exposing a diamond seed to high pressure and temperature conditions. The diamonds growth in HPHT machines were developed in the 1950s by General Electric and the technique has since remained largely the same.
In the HPHT method, there are three main press designs used to supply the pressure and temperature necessary to produce synthetic diamond: the belt press, the cubic press and the split-sphere (BARS) press. Diamond seeds are placed at the bottom of the press. The internal part of press is heated above 1400 °C and melts the solvent metal. The molten metal dissolves the high purity carbon source, which is then transported to the small diamond seeds and precipitates, forming a large synthetic diamond.

HPHT technique greatly restricts the size and quality of diamonds and often results in brown or orange colored diamonds. Due to low yields, limited sizes and presence of metallic and other impurities, the applications of HPHT grown diamonds have in fact been limited in comparison to a diamond's great potential. The above factors restrict the potential of HPHT grown diamonds in high technology and gem applications.(Refer Exhibit 2,3)

1.2.2 CHEMICAL VAPOR DEPOSITION (CVD)

Chemical Vapor Deposition (CVD) using microwave plasma (MPCVD) is a method by which a diamond can be grown from a hydrocarbon gas mixture. The CVD growth of carbon nanomaterials consists of several stages:

- Substrate heating/conditioning
- Growth
- Substrate cooling

To start, CVD technique decomposes carbon-containing gas molecules such as methane, acetylene or carbon dioxide at sub-atmospheric pressure that deposits diamond as a film on a substrate. Diamond formation by CVD is normally performed under high heat conditions using a gas based carbon source in an excess of hydrogen. Two of the more popular experimental methods include the use of a hot filament reactor (HFCVD) and the use of a microwave plasma reactor (MPCVD). While each method differs in detail, they all share features in common.
(Refer Exhibit 2,3)

1.2.3 HOT FILAMENT CVD (HFCVD)

This method is the earliest method used for the growth of diamond. When the filament is heated to high temperatures and as hydrogen is passed over the hot filament, atomic hydrogen could be easily produced. The simultaneous production of atomic hydrogen during hydrocarbon pyrolsis enhances the deposition of diamond, by suppressing graphite formation. HFCVD possesses the ability to adjust to

[3] *Grown Diamonds- Shaping Future of Diamond Industry, Frost & Sullivan, 2013*

a wide variety of carbon sources such as methane, propane, ethane and other hydrocarbons. Even oxygen containing hydrocarbons including acetone, ethanol and methanol can be applied. The addition of oxygen-containing species may widen the temperature range within which diamond deposition take place.

1.2.4 MICROWAVE PLASMA CVD (MPCVD)

This is another CVD method in which the microwave plasma is used to dissociate molecular hydrogen into atomic hydrogen and active carbon species into promoting diamond formation. The excitation frequency for microwave plasma CVD is typically 2.45GHz. Microwave plasma is unique in that microwave frequency can oscillate electrons. High ionization fractions are generated as electronics collide with gas atoms and molecules.

Among all the CVD techniques, MPCVD provides stable conditions for producing high quality single crystal diamonds. With the aids of these techniques for diamond formation, we are no longer dependent on natural diamond sources and can achieve properties well beyond those of natural diamond.
(Refer Exhibit 2,3)

Exhibit 2: Key Techniques for Growing Diamonds

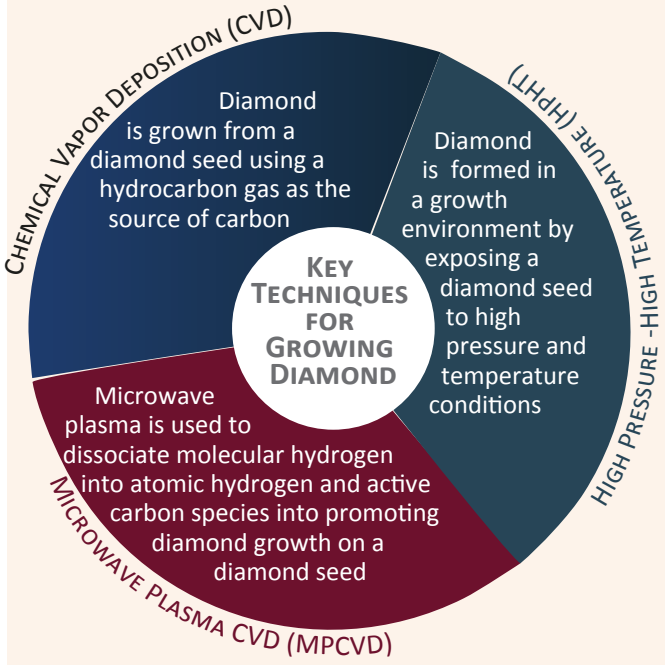


Exhibit 3: Process of Growing Diamonds

01	Diamond seed is placed into a low-pressure microwave chamber.
02	Diamond Seed is placed on growth platform ; Temperature and pressure of the chamber is controlled
03	Inject ultra pure carbon rich & other gases energy is pumped into chamber that ignites plasma ball
04	High-energy carbon precipitates out of a plasma cloud and is deposited on the seeds & form
05	Diamond seeds gradually grow layer by layer into diamond crystals
06	Within 6-10 weeks pure grown diamonds are matured in the form of diamond crystals.

1.1.3 INCREDIBLE JOURNEY OF DIAMONDS

Diamonds are beautiful, mysterious and rare mineral resource.. Diamonds have been adored for centuries for their scintillating & exceptional beauty . The stone is believed to be a symbol of love, purity and eternity. Diamond comes from the Greek word 'Adamas,' which implies unconquerable and indestructible. In Sanskrit, the word most generally used for diamond is transliterated as 'vajra'. For centuries, starting around 4th century BC, India was the only source of diamonds. Some of the world's most famed diamonds such as the Koh-i-noor, the Orlof, the Great Mogul, Fancy Hope, Florentine, Nassak, Regent, Pitli, Nizam, etc. were mined from India. In 1725, Brazil and in 1870 South Africa emerged as major sources of diamonds and today diamonds are mined in more than 20 countries including Australia, Botswana, Canada, Ghana, Russia, among others.
(Refer Exhibit 4)

> **Diamonds** *are formed when carbon atoms crystallize into cubic structures with tetrahedral bonds*
>
> *Some of the world's most famed diamonds such as the Koh-i-noor, the Orlof, the Great Mogul, Fancy Hope, Florentine, Nassak, Regent, Pitli, Nizam, etc. were mined from India.*

KOH-I-NOOR DIAMOND WAS MINED FROM KOLLUR MINE IN ANDHRA PRADESH (INDIA). IT WAS ORIGINALLY 793 CARATS WHEN UNCUT & IS A TYPE IIa DIAMOND

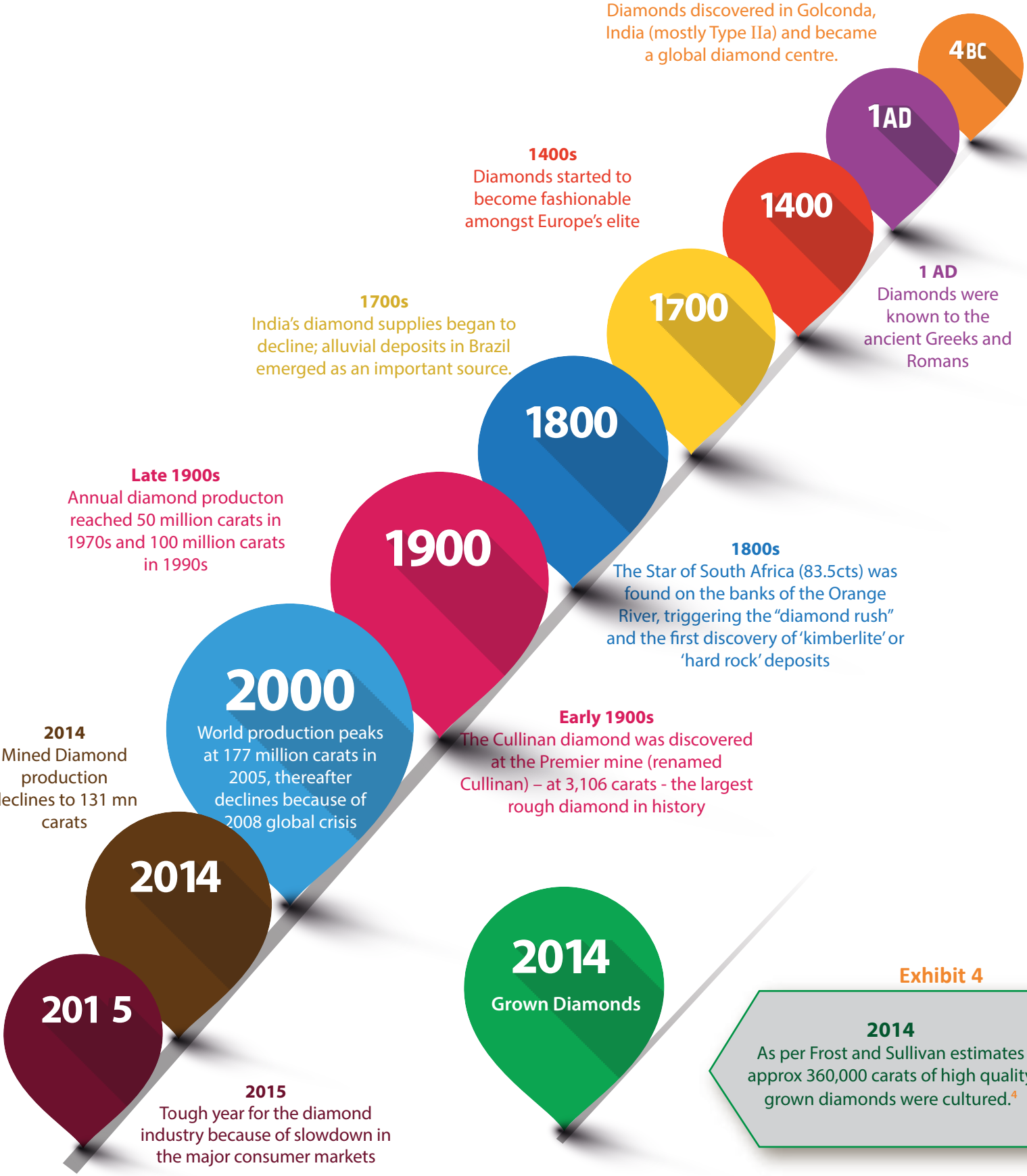


Exhibit 4

2014
As per Frost and Sullivan estimates approx 360,000 carats of high quality grown diamonds were cultured.[4]

[4] *Grown Diamonds : Unlocking Future of Diamond Industry by 2050, Frost & Sullivan Report, December 2014*

02

Mined Diamonds & Grown Diamonds: A Comparison

2. Mined Diamonds & Grown Diamonds: A Comparison

Diamonds grown by scientists in the laboratory instead of created in the earth's crusts are grown diamonds and are identical to Earth Mined Diamonds in every way.(Refer Table 1) They are real diamonds with the only differentiator being the point of origin. In order to ascertain that Grown Diamonds are 'Real' diamonds a comparison pertaining to their basic facts is presented as follows.

2.1 Physical Properties

This is to mention that both grown diamonds as well as earth mined diamonds have similar physical properties in terms of hardness, specific gravity, refractive index and dispersion. This is apparent from the following table which shows that grown as well as mined diamonds has 10.00 as hardness, 3.52 as specific gravity, 2.42 as refractive index and 0.044 as dispersion. While, there is a wide variations across all these properties in case of other simulants viz. Moissanite, Cubic Zirconia, White Sapphire and Yag.

The other physical characteristics viz. color zoning, metallic inclusions, zoned florescence, artifacts, magnetism, extreme hardness, thermal conductivity, thermal expansion, optical transparency, electrical resistivity, compressibility, bulk modulus of grown diamonds and high quality mined diamonds are also similar which verify that grown diamonds are as real as mined diamonds.

2.2 Chemical Composition

Carbon is one of the basic building blocks of life on our planet and diamonds whether grown or mined are made up of only carbon.(Refer Table 3) Unlike imitations such as cubic zirconia stones that are "grown" in labs have the same chemical composition as the mined diamonds. They are made from a carbon seed placed in a microwave chamber and generally chemical vapor deposition (CVD) or high pressure high temperature (HPHT) methods are used. CVD uses ultra-pure carbon rich gases in a controlled environment. HPHT which has been in use since 1950s puts a pure, solid carbon source under high pressure and high temperature. In the presence of a catalyst , the pressurized and heated carbon crystallizes into diamond.

2.3 Intrinsic Purity

Diamonds fall under several different "Types" of which Type IIa is the rarest. When CVD process is used to grow the diamonds in laboratory, it produces Type IIa diamonds which have no or almost no impurities and are the purest and high quality diamonds.(Refer Table 2) This accounts for only 2% of the world's Earth-mined Diamonds, while 100% of Gem-Quality Colorless Grown Diamonds are intrinsically of this type. This puts grown diamonds in the same line as the famed Golconda diamonds, the Cullinan, the Elizabeth Taylor Diamond, and the Koh-i-noor diamond. Thus, the grown diamonds are well deserved to be recognized as real diamonds.

> **Orchids** *are elegant flowers that grow across almost all continents. With the right environment and settings, Orchids do grow in Greenhouses too. Just because these Orchids grew in Greenhouses and not in Amazon rainforests, it does not make them artificial, synthetic or fake*

Table 1: Comparison of Physical Properties of Diamonds - Grown, Earth Mined and Simulants

Stone Type		Hardness	Specific Gravity	Refractive Index	Dispersion
Grown Diamond		10.00	3.52	2.42	0.044
Earth Mined Diamond		10.0	3.52	2.42	0.044
Simulants	Moissanite	9.25	3.21	2.65	0.104
	Cubic Zirconia	8.50	5.65	2.15	0.060
	White Saphire	9.00	3.97	1.77	0.018
	YAG	8.25	4.60	1.83	0.028

Source : PHD Research Bureau, compiled from Better Diamond Initiative

Table 2: Comparison of Basic Facts: Grown Diamonds vis-à-vis Earth Mined Diamonds

Particulars	Grown Diamond	Earth-Mined Diamonds
Physical Properties	Identical	Identical
Chemical Composition	Carbon	Carbon
Intrinsic Purity	Rare and Purest (Type IIa)	Rare and Purest (Type IIa)
Sources of Diamonds	Diamond growing greenhouse	Excavation of earth
Is it Synthetic	No	No
Is it fake	No	No
Is it Artificial	No	No
Certified by Labs	No	Yes
Life of Diamond	Eternity	Eternity

Source : PHD Research Bureau, compiled from Better Diamond Initiative

Table 3: Chemical Composition of Grown vis-à-vis Earth Mined Diamonds

Diamonds Type	Chemical Formula	Category	How it is formed?
Grown Diamond	Carbon, C	Native Element	Under high pressure and temperature by crystallization of carbon in HPHT or CVD machines(Since only carbon is involved which is a native element, hence no synthesis is involved in growing rough diamonds)
Earth Mined Diamond	Carbon, C	Native Element	Under high pressure and temperature by crystallization of carbon deep inside earth. (Only carbon is involved, which is a native element, for the formation of rough diamond)

Source : PHD Research Bureau, compiled from Better Diamond Initiative

2.4 GROWN DIAMONDS ARE NOT SYNTHETIC

Synthetic products are products which result from "synthesis" or "mixing" or "chemical reaction" of two or more different elements. For this reason, as shown in the tables below, products like Cubic Zirconia, Moissanite, White Sapphire or YAG are synthetic. Unlike these synthetic products,grown Diamonds (like Earth-mined Diamonds) are made purely of Carbon. Since only carbon is used to grow diamonds in HPHT and CVD processes where the growth process involves natural deposition of carbon atoms over a diamond seed and there is NO "SYNTHESIS" INVOLVED, therefore, grown diamonds cannot be called Synthetic.(Refer Table 3)

All simulants viz. Cubic Zirconia, Moissanite, White Sapphire, YAG, are chemically composed of two or more different elements. Only grown diamonds are purely made up of Carbon, C and the conditions are recreated in terms of pressure and temperature identical to deep inside earth within mantle.
(Refer Table 4)

Table 4: Chemical composition and formation process of diamonds and simulants

Name	Composition	Formation Process
Cubic Zirconia	Zirconium Oxide, ZrO_2	Formation of cubic zirconia by reactive arc evapor -ation in a mixture of nitrogen-oxygen reactive gas
Moissanite	Silicon Carbide, SiC	Combination of silica, carbon and sand under high temp and pressure till a crystal is formed
White Sapphire	Aluminium Oxide, Al_2O_3	Produced from agglomerated Aluminium Oxide, sintered and fused in an inert atmosphere
YAG	Yttrium Aluminium Garnet, $Y_3Al_5O_{12}$	Synthesized at 1000 °C from the milled mixture of Y2O3 and Al2O3
Grown Diamond	Carbon, C	Under high pressure and temperature by crystallization of carbon in HPHT or CVD machines
Earth Mined Diamond	Carbon, C	Under high pressure and temperature by crystalliza -tion of carbon deep inside earth within mantle

Source : PHD Research Bureau, compiled from Better Diamond Initiative

2.5 Grown Diamonds are neither fake nor artificial

Grown diamonds, similar to greenhouse for Orchids are formed in 'Diamond Growing Greenhouse' wherein ideal environment for diamond growth is provided by replicating nature like favorable conditions to allow growth of 'Diamond Seed' (carbon source). Therefore, Grown Diamonds are real as Earth-mined Diamonds in respect of chemical composition, strength and luster.

2.6 Grown Diamonds are certified by labs

Diamond Certificates are issued only for real diamonds and not for simulant or synthetic materials. Grown Diamonds like Earth-mined Diamonds are certified by leading Gemological labs globally viz. International Gemological Institute (IGI). In the certificate issued for a colorless grown diamond, the labs identify them as Type IIa diamonds and these certificates are identical to mined diamond certificates including grading of the 4C's along with full disclosure of the grown diamond origin.

> **Grown Diamonds**, *similar to greenhouse for Orchids are formed in 'Diamond Growing Greenhouse' wherein ideal environment for diamond growth is provided by replicating nature like favorable conditions to allow growth of 'Diamond Seed'*

03

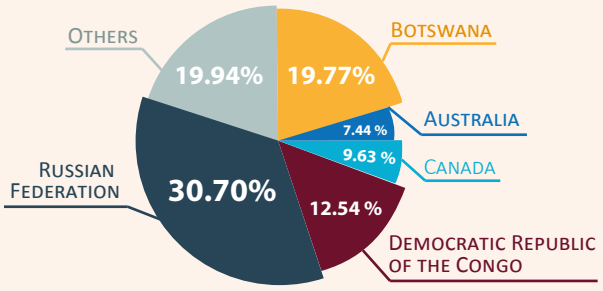
Where Is The Global Diamond Industry Headed?

3. Where Is The Global Diamond Industry Headed?

Diamonds are one of the world's major mineral resources excavated from earth. The diamond industry has witnessed a significant growth over a period of time and has become culturally, socially and economically significant for the society at large. An estimated US$13 billion worth of rough diamonds are mined per year which reportedly generates employment for approximately ten million people around the world, both directly and indirectly, across a wide spectrum of roles from upstream (Exploration & Mining) to mid-stream and downstream (cutting, polishing & jewellery manufacturing to sales and distribution).[5]

The world diamond market is represented by diamond mining and trade in rough diamonds which is majorly concentrated in five countries including Russian Federation (30.7%), Botswana (19.77%), Congo Democratic Republic (12.54%), Canada (9.63%) and Australia (7.44%) (Refer Figure-1).These countries constitute around 80% share in the global production of diamonds in physical term.

Figure 1: Country wise % Share Diamond Production by Volume (carats) - 2014



Source : PHD Research Bureau, compiled from Kimberley Process Certification Scheme

According to Kimberley Process Certification Scheme Data 2015, around 125 million carats of rough diamonds were mined in 2014 with a total value of US $14.5 billion[6] . Diamond mining production touched its peak in 2005 at 177 million carats which thereafter was severely hit by global financial crisis of 2008. Annual global diamond production fell to 163 million carats in 2008 and further declined to 120 million carats in 2009[7] (Refer Figure -2)

Meanwhile, global diamond jewellery sales have increased three-fold in the past 25 years, and are currently worth in excess of US$72 billion.[8]

> **Global mined diamond** *production touched its peak in 2005 at 177 million carats which thereafter fell to 163 million carats in 2008 and further declined to 120 million carats in 2009. Though, the industry has shown a growth in recent years, yet could not achieve its pre-crisis level.*

Falling rough diamond supply is a major issue the industry is facing since the start of this century and this situation is expected to aggravate further. (Refer Figure-3). This is majorly attributed to decline in supply of mined diamonds on one hand and rising demand on the other. By 2030, rough production will fall by 50%+ from current levels and only 14 million carats of rough mined diamonds will be available by 2050. 30 major mines will reach their End of Life by 2035, while no new mines have been discovered in last 2 decades.

At this juncture, it is imperative for the global economy including countries like India to look for a supplementary diamond product like 'Grown Diamonds' because they are identical to mined diamonds and can help industry to circumvent the projected critical situation of scarcity of mined diamonds, its advent will create direct and indirect employment and rejuvenate the diamond industry

[5] World Diamond Council
[6] Kimberley Process Certification Scheme, Global Rough Diamonds, 2015
[7] IBID
[8] World Diamond Council

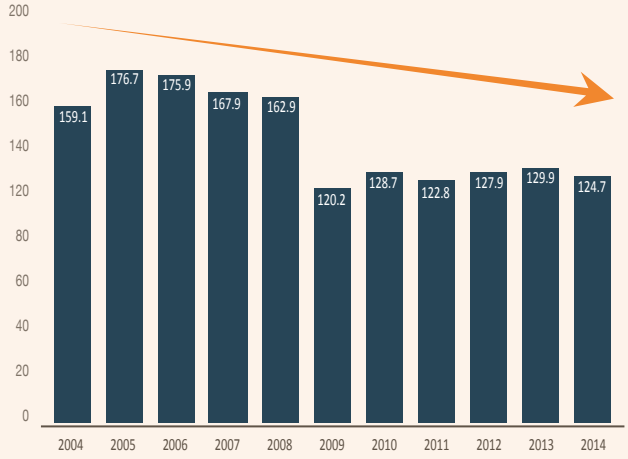
Mined Diamond Supply Is Stagnant & Declining [9]

- *The world's major diamond mines are maturing and past their production peak*
- *Only 15 new mines are expected to become operational in next 40 years. All these new mines together are expected to add only 18 million carats each year by 2023 in comparison to over 120 million carats produced at present by all mines globally*
- *Just seven existing diamond mines (Jwaneng, Orapa, Udachny, Venetia, Catoca, Mir and Cullinan) are considered tier 1 deposits (+US$20 billion reserves)*

Diamond Demand Is Rising[10]

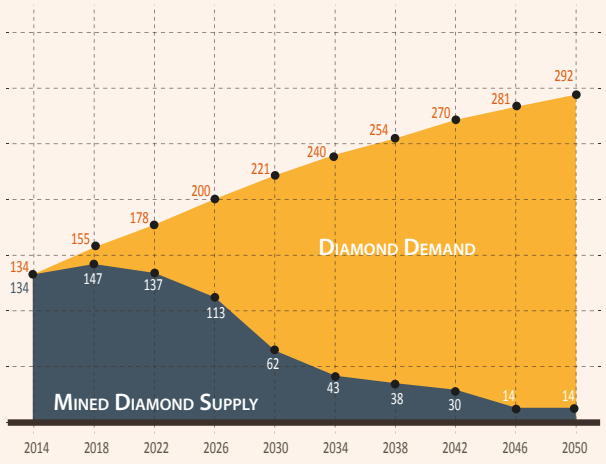
- *The middle classes worldwide are growing. The global middle class could constitute 50% of the world's population by 2030, up from 29% in 2008*
- *By 2030, around one billion people in China could be middle class – as much as 70% of its projected population. India's middle class is expected to reach 475 million people by 2030*
- *The Chinese market is the fastest growing, sales of diamond jewellery to Chinese consumers were the fastest growing in the world over the last decade, with a CAGR of 21% from 2003 to 2013*

Figure 2: Annual Global Mined Diamond Production (Million Carats)



Source : PHD Research Bureau, compiled from Kimberley Process Certification Scheme, 2015

Figure 3: Diamond Demand-Supply Gap



Source : PHD Research Bureau, Compiled from Frost & Sullivan, 2014

[9] *Grown Diamonds : Unlocking Future of Diamond Industry by 2050, Frost & Sullivan Report, December 2014*

[10] IBID

04

A 'Realistic' View Of The Indian Diamond Industry

4. Indian Diamond Industry: Key Facts & Trends

India is one of the leading diamond processing centres of the world. India's vast, low cost and extremely skilled workforce provides it with a competitive edge over other countries.

Surat, Navsari, Bhavnagar, Amreli are commonly acknowledged as the diamond manufacturing hubs while Mumbai has emerged as the diamond-trading hub. The exports of cut and polished diamonds constitute around 47% of the gems and jewellery exports from India (Refer Table-4) and at the global level,

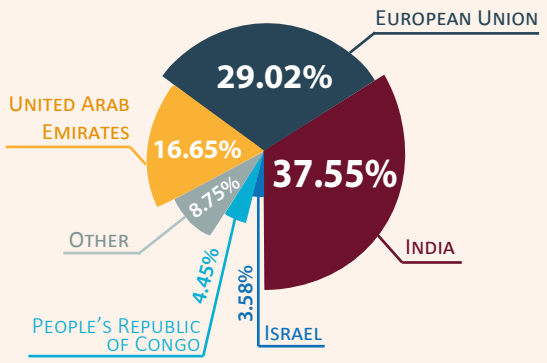
European Union, UAE, Botswana, Russian Federation and India are the major exporters of diamonds worldwide. The countries combined constitute for around 73% of global exports (307 million carats) of diamonds. India, European Union, UAE, People's Republic of and Israel are also the major import destinations which comprise of 376.76 million carats, or around 90% of the global imports of diamonds from the rest of the world (Refer Figure 4 & 5).

It would be prudent to say that India has an important position in the global diamond industry as the leading manufacturing centre of cut and polished diamonds because of its talented artisans, skilled in working upon mostly small-sized diamonds.

Even though the domestic industry has been on a rollercoaster ride since the global financial crisis of 2008, Bain's Global Diamond Report 2014 underlines that operating margins for cutters and polishers and traders held steady in the 1–4% range with margins being widely dispersed than in previous years.[11]

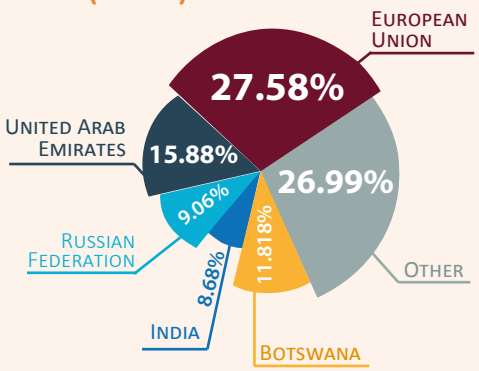
> **The positive revenue** *growth of 4% in global cutting and polishing market is majorly confined to India and the country has a share of more than 60% of the cutting and polishing global market.*

Figure 4: Countrywise Mined Diamond Imports by Volume (carats)



Source : PHD Research Bureau, compiled from Kimberley Process Certification Scheme, 2015

Figure 5: Countrywise Mined Diamond Exports by Volume (carats)



Source : PHD Research Bureau, compiled from Kimberley Process Certification Scheme, 2015

[11] Diamonds: Timeless Gems in a Changing World, Bain & Company, 2014

Table 5: % Share of Cut & Polished Diamonds Exports in India

Year	Gems & Jewellery (in US $bn)	Cut & Polished Diamonds (in US $bn)	% Share of Cut and Polished Diamonds in Gems &Jewellery
2004-05	15.6	11.1	71.5
2004-05	16.7	11.8	70.66
2004-05	17.1	10.9	63.74
2004-05	20.9	14.2	67.94
2004-05	24.8	14.8	59.68
2004-05	29.4	18.2	61.90
2004-05	43	28.2	65.58
2004-05	43.2	23.3	53.94
2004-05	39.1	17.43	44.58
2004-05	41.3	19.6	47.46

Source : PHD Research Bureau, compiled from Gems and Jewellery Export Promotion Council

4.1 Rising Prices, Squeezing Profitability

Prices of rough diamonds have increased by 70%, while polished diamond prices increased by only 30%, resulting in profit margins (PBT) of diamond manufacturers shrinking to 0.3% - 2.3%. Many large scale manufacturers/traders may be facing problems in terms of shrinking price cost of margins in the slowdown period

4.2 Employment Loss, A Critical Issue

Employment remains a critical issue for the Indian government that has been working to revive economic growth to a rate that will generate employment for millions joining the workforce every year. The Indian diamond industry at its peak a decade ago employed over a million people.[12] Falling rough diamond supply, emergence of new cutting and polishing centers and shifting of diamantaires to producing nations under diamond beneficiation are resulting in steady fall in the size of industry within India. As part of De Beers' 'Supplier of Choice' strategy, Sightholders are selected based on extent of domestic beneficiation, on which allocation of rough supply by DTC in Botswana also depends. De Beers forecasts that 50%+ high quality diamonds will be locally cut and polished in producing countries, in future.

[12] RBI's report of the Task Force for Diamond Sector, Feb 2013

4.3 DEVALUATION OF RUPEE

Affecting Indian diamond industry competitiveness - The Indian cutting-and-polishing market had contracted by 5% in 2012, squeezed by a slowdown in domestic demand and devaluation of the rupee Indian cutters and polishers were hit hard when the value of the rupee fell 20% in 2011 and hit all-time lows in 2012, constraining their liquidity in the rough-diamond market, which is priced in US dollars. Three years later, weaker Asian and European economic conditions have once again halted the domestic Indian diamond industry's movement, affecting the midstream diamond manufacturers the hardest.

4.4 WEAK DEMAND IN GLOBAL MARKET, BLOW TO INDIA'S EXPORTS

The Indian diamond processing sector is plagued due to weak demand of polished diamonds in its key markets such as the US, the Middle East, China, Hong Kong, expensive rough, slow moving inventories, reduced bank finance, and reduction in the credit period. KPMG, an international tax and accounting firm headquartered in the Netherlands, forecasts that by 2015, the global share of China's diamond processing industry will reach 21.3%, while India's share will decline from its current 57% to 49%.[13]

ECONOMIC ANALYSIS

India's diamond exports are in sync with the growth of global diamond industry. The global diamond production declined from a peak level of 177 million carats in 2005 to 125 million carats in 2014 witnessing a decline of around 30% during the said period. On the same line, the share of cut and polished diamonds in India's overall Gem and Jewellery exports also declined from 71% in FY2005 to 47.46% in FY2014.(Refer Table 5) Structural changes in the production possibility scenario vis-à-vis subsided demand scenario have tilted the global diamond industry.

At this stage, it is imperative for the government to undertake appropriate policy measures so that decline in diamond industry, which is crucial for the country in terms of employment and foreign exchange earnings, can be arrested in the coming times.

[13] The Gujarat Diamond Cluster: Is it Forever?, Microeconomics of Competitiveness, 2008

05

Impact Analysis Of Grown Diamond Processing In India

5. Impact Analysis Of Grown Diamond Processing In India

Grown diamonds are one of the most promising developments in diamond industry and gaining acceptance increasingly across various segments of the society because of its being impactful pertaining to several aspects and wide range of benefits and applications. Impact and benefits of grown diamonds are discussed here below.

5.1 GROWN DIAMONDS: A VEHICLE TO PROPEL ECONOMY'S GROWTH

Grown diamond industry is seen as a significant vehicle to propel overall economy's growth attributing to its high tech systematic formation processes which generates employment for highly skilled people, provides base for several ancillary industries related to gems and jewellery, optics, electrical, thermal chemicals etc. and makes addition to the overall economic value to the economic system. Furthermore, the grown diamond industry presents itself as a sustainable source of supply of diamonds which can help in maintaining livelihood of many people.

There are several diamond consumption areas which remain un-serviced today. Grown Diamonds owing to their similar physical, chemical and optical properties and steadily increasing production levels, acceptance & recognition in the market can be a perfect supply source for several industries in the economy.

5.2 IMPROVING & GROWING EMPLOYMENT POOL

The country has massive advantage, both on cost of processing and expertise needed to cut & polish various qualities of diamonds. This ready talent pool (albeit a shrinking one due to mined diamond supply shortages), a basic manufacturing infrastructure that can be easily upgraded to accommodate value-added grown diamond processing, market experience and a developing domestic economy is what makes India an attractive cutting & polishing centre.

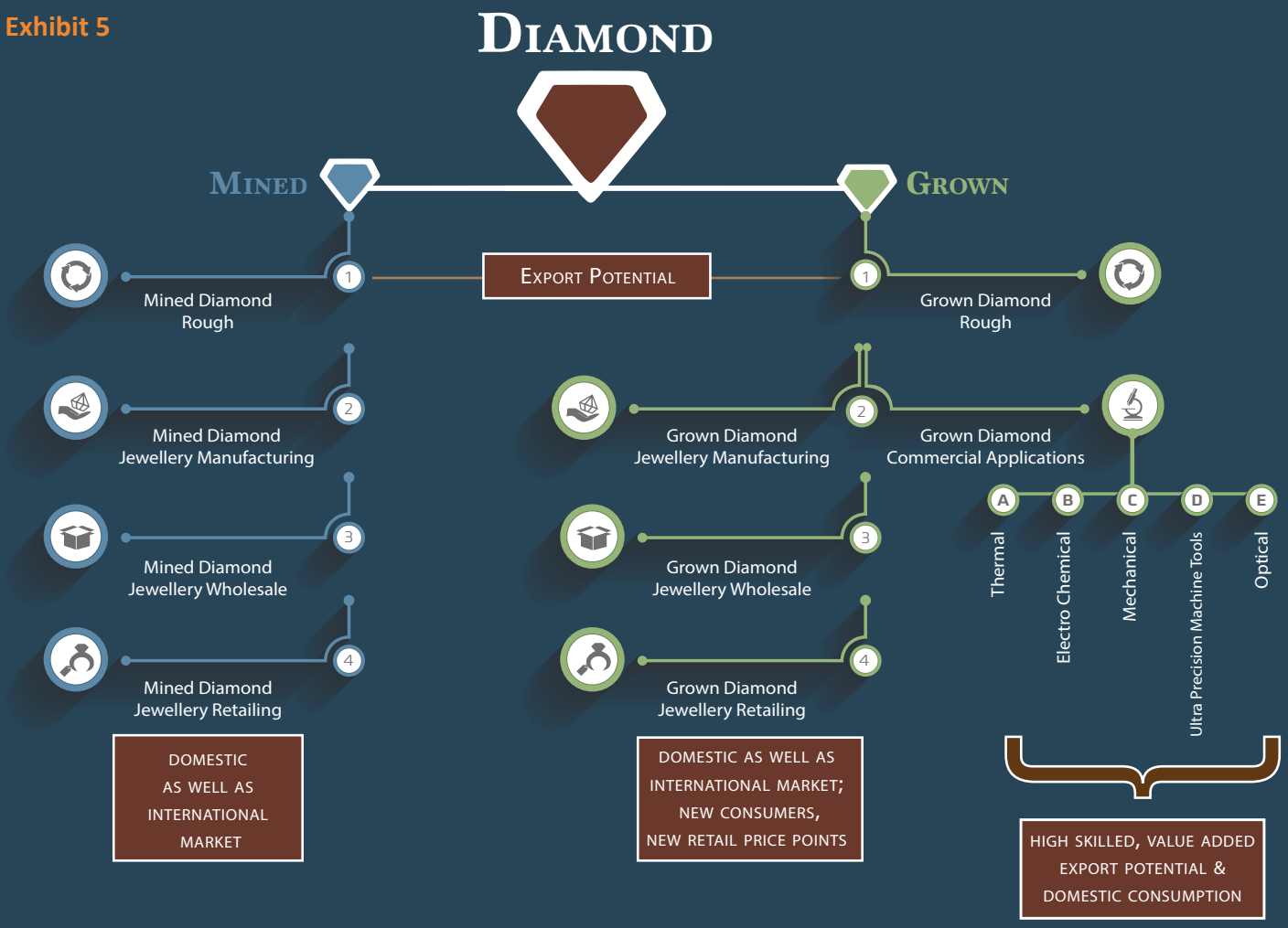
While growers of high quality diamonds are mostly in developed countries, they are looking to establish long-term trade partnerships with established diamond manufacturing hubs like India. Nurturing high-skilled craftsmen to process grown diamond rough and supply custom cut grown diamonds for highly specialized commercial purposes such as optical, precision engineering, mechanical applications etc. and even potentially open manufacturing opportunities within the country will not only bring in foreign investments but also enhance export from India.

Approximately 2000 people are currently employed globally for an estimated 360,000 carats of grown diamond processing. Within next three decades, grown diamond industry could potentially employ over a million people in order to process 150 million carats of grown diamond rough.[14]

Likewise, conducive and future-looking trade policies that will appeal to global diamond growers to process their grown diamond rough in India needs to be implemented now. India can take the lead in giving support and direction to this budding grown diamond industry.

[14] *Grown Diamonds : Unlocking Future of Diamond Industry by 2050, Frost & Sullivan Report, December 2014*

Exhibit 5



5.3 ADDING VALUE TO INDIAN EXPORTS

Grown Diamonds promise to become an important value-added export good for India. Processing is the most important step in the diamond supply chain since it is at this stage where the greatest value addition takes place. Cutting and Polishing centres in Antwerp, Tel Aviv, Israel, India, China, Johannesburg, New York and Thailand compete with each other for supply of good quality diamond rough. Grown Diamonds, which are an emerging but steadily growing and consistent in supply quality, have had a promising start in the US consumer market. Diamond growers, today process their high quality rough across international markets but India can easily position itself as the grown diamond processing base supplying to consumer and commercial markets, and take its cutting and polishing sector up the value chain and also extend its revenues. (Refer Exhibit 5).

It is important to note that by 2025, a new global 'consuming class' will have emerged and the majority of consumption will take place in developing economies, like India and China. This will, in turn, create rich new market opportunities for the diamond sector. A recent study by the McKinsey Global Institute (MGI) suggests that if India continues to grow at the current pace, average household incomes will triple over the next two decades,

making the country the world's fifth-largest consumer economy by 2025, up from the current 12th position.[15]

By processing grown diamonds in India, government can ensure that the burgeoning domestic market has easy and affordable access to grown diamond rough, which can emerge as an important supply source for the domestic processing industry. Meanwhile, McKinsey insights also suggest that demand in established markets is fragmenting as customers ask for greater variation and more types of after-sales service[16]. This where Indian diamond industry can easily expand its retail offering, position itself as a hub that can add value by customizing grown diamond products for various applications, introduce varying price points depending on diamond application and focus on creating a valuable services bouquet to its global consumers.

5.4 RECOGNIZING EMERGENCE OF A RESPONSIBLE & SUSTAINABLE LUXURY

Diamonds are the most elegant, unique and beautiful precious stone on this planet earth and therefore adored by people for centuries. Today an increasing number of consumers would like to ensure their luxury has originated from sustainable resource and has not had a negative effect on the ecology where it has been processed or finished. Grown diamonds are grown using natural crystallization processes inside greenhouses, taking anywhere between 14 and 16 weeks to result into a rough diamond from the diamond seed. Diamond – whether grown inside earth or above earth – take the same amount of time to grow since they are governed by laws of crystallization in both environments.

Just as the 'Pearl Boom' helped an entire industry survive the gradual extinction of pearls' Earth's supply, ensuring the finest quality and widest choice of pearls was still available for the consumers, likewise, the emerging 'Grown Diamond Age' is set to tread the same path. (Refer Exhibit 6) In both cases, the underlying point is to ensure that the consumer is always aware and educated about the virtues of the luxury product they are buying by means of certification and offering choices based on individual preferences – sustainable, affordable, origin-guaranteed and certified assurance for quali-

- ✓ *Ensures diamonds have originated from sustainable resource*
- ✓ *Does not have negative ecological impact*
- ✓ *Takes 14-16 weeks to grow into a rough diamond from diamond seed*
- ✓ *Grown diamonds production will not overtake Mined Diamond production but supplement them over the next 2 decades*
- ✓ *No contribution to conflict areas arround the world*

[15] 'Manufacturing the future: The next era of global growth and innovation,' Nov 2012, McKinsey

[16] IBID

Exhibit 6:

DÉJA VU - DEPLETING SUPPLY OF NATURAL PEARLS LED TO BIRTH OF CULTURED PEARL INDUSTRY

In the early 1900s, natural pearls were the height of fashion and an important indicator of wealth and status. Already prized in Europe, India and China for centuries, the market was boosted by an emerging wealthy American market keen to own pearls from old European families, and embody themselves with a pedigree by association.

Since pearl oysters were found in only a few regions–such as the Persian Gulf, Fresh water rivers & ponds in China, and coastal Japan – pearls remained expensive and could be afforded by only aristocrats. Just one in 10,000 oysters produced a natural pearl! Not to mention the fact that pearl diving was also a dangerous venture. Like the diamond industry, natural pearls too have a dark side.

Slaves were forced to dive for them in the 16th century Caribbean and South America, and throughout the world, pearl divers remained poor while traders reaped the profits. It is said that the world's best pearls came from the Persian Gulf, especially around what is now Bahrain. But the natural pearl industry of the Persian Gulf ended abruptly in the early 1930's with the discovery of large deposits of oil. Those who once dove for pearls sought prosperity in the economic boom ushered in by the oil industry. The water pollution resulting from spilled oil and indiscriminate overfishing of oysters across globe also contributed in depletion of natural pearls.

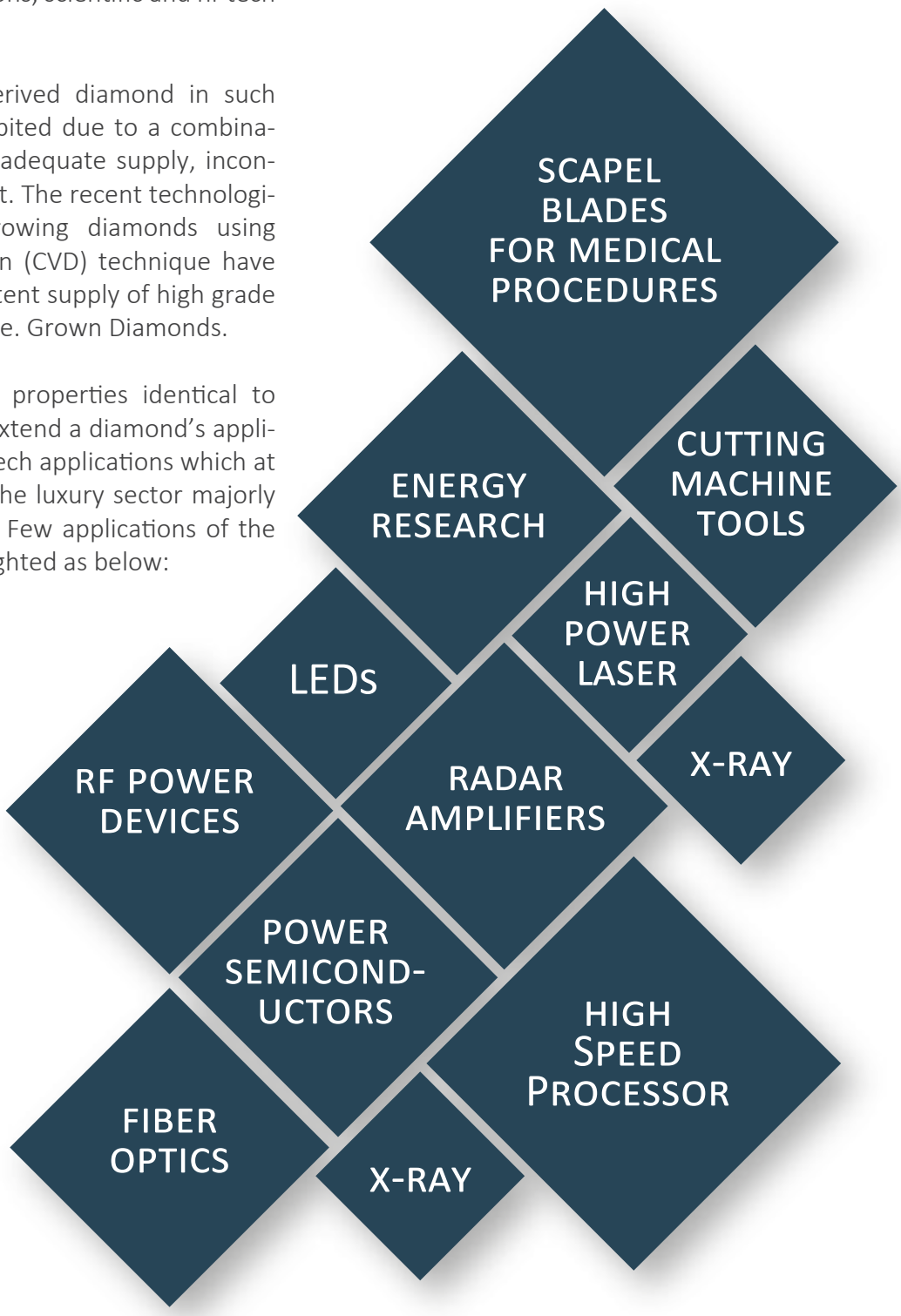
As the gulf between the supply of natural pearls and demand widened, it was cultured pearls that helped in creation of a new industry, supplementing the existing pearl supply chain and ensuring consumers had a wider yet an assured quality choice for their pearls.

5.5 GROWN DIAMONDS: IDEAL FOR COMMERCIAL APPLICATIONS

Diamond is well known for its exceptional brilliance & beauty. But it is also recognized as a remarkable material with superlative optical, thermal, electro-chemical, chemical and electronic properties. These, when combined, give rise to three distinct types of applications: gem applications, scientific and hi-tech commercial applications.

However, use of earth-derived diamond in such applications has been inhibited due to a combination of factors including inadequate supply, inconsistent quality and high cost. The recent technological advancements for growing diamonds using chemical vapour deposition (CVD) technique have paved the way for a consistent supply of high grade Type IIa quality diamonds i.e. Grown Diamonds.

Grown Diamonds possess properties identical to mined diamonds and can extend a diamond's application to scientific and hi-tech applications which at present is limited only to the luxury sector majorly due its various limitations. Few applications of the grown diamonds are highlighted as below:



Grown Diamonds, A Sunrise Industry: Concerns And Suggestions

6. Grown Diamonds, A Sunrise Industry: Concerns And Suggestions

Grown Diamonds accrue several benefits to an economy in terms of generating employment, earning foreign exchange and providing a sustainable, ecological and origin guaranteed source of diamonds. Presently, grown diamonds are imported in India from Singapore, US, Europe, Russia and Malaysia for cutting & polishing and re-export to major diamond markets. In the light of rising shortages and prices of earth mined diamonds, grown diamonds are gradually gaining acceptance at the global level including India. Furthermore, it is considered as a 'Sunrise Industry' in the country owing to its several invaluable benefits and applications.

However, grown diamonds despite being identical to mined diamonds and carrying huge commercial potential are facing few concerns in India. One, the grown diamonds are misperceived as 'Synthetic Stones' as the product is placed under HS Code 7104 which is for 'Synthetic Stones'. Two, people are not aware about the availability of a new choice in diamonds that are identical to mined diamonds. These are some of the concerns which are associated with Grown Diamonds in the country which if timely and effectively addressed by the Government will be a win-win situation for various segments of the economy viz. Industry, Government , Customers and the Society as a whole

At this juncture, it is imperative for the Government to put a special focus upon grown diamonds by reviewing its HS Code classification and undertaking special promotional measures to position them rightly and effectively in the country.

Concerns along with few suggestions, associated with the Grown Diamonds are discussed here below:

1. HS code classification for Grown Diamonds is not appropriate:

Grown Diamonds are identical to mined diamonds, except for their point of origin like Cultured Pearls are for Natural Pearls. However, diamonds grown in earth are recognized in HS Code 7102 and diamonds grown in greenhouses as part of HS code 7104 (a category created for synthetic stones). This inappropriate HS Code Classification for Grown Diamonds is resulting erroneous results for the entire grown diamond industry viz.

- Creates wrong image of the product as 'Synthetic Diamonds' in the minds of people across all Segments viz. industry , retail buyers and so on.
- Industry remains deprived of putting grown diamonds in several applications including Gem & Jewel lery as the prouct is assumed to be 'Synthetic'.
- Accrue less commercial value for the traders and economic value for the country
- Government is not able to derive various benefits of upcoming grown diamonds industry effectively in terms of generating distinct pool of employment, enhancing exports and propelling overall econo my's growth.

2. Lack of awareness about Grown Diamonds in the country -

For the first time in history, man is now capable of growing genuine diamonds above the ground and rightly named as 'Grown Diamonds'. However, people in the country are still unaware about features and benefits of grown diamonds in terms of their originality, sustainability, pricing and applications. No special promotional efforts have been made at the trade level as well as at the government level to position grown diamonds in the country till now. Therefore, the stakeholders are still deprived of buying genuine diamonds at a better value.

Suggestions In order to address these concerns are enlisted here below:

1. Allot distinct sub-category for two diamonds but under same heading (7102) -

The current HS code (7104) that covers grown diamonds creates a wrong image in the minds of stake-holders pertaining to about the grown diamonds. Though, mined and grown diamonds come from different sources but grown diamonds are REAL diamonds as they are purely made up of carbon. Therefore, it is essential that people in the trade as well as consumers should be aware of the origin difference while also recognizing that they both are same. Taking this into consideration, grown diamonds are suggested to be covered through the same HS code that categorizes Diamonds i.e. HS code 7102 but under a unique sub-category at the 6th and 8th digit level.(Refer Table 6,7).

With a trade precedent that classifies 'Same product but from different origin' is already in practice. The HS classification for cultured pearls and natural pearls where both are in the same ITC category (7101) are differentiated at 6th and 8th digit level i.e.- 1010 & 1020 for natural pearls and 2100 & 2200 for cultured pearls. Thus, in consistency with the same policy for cultured pearls and natural pearls, grown diamonds should be put under the category of diamonds, HS code (7102) and further sub categorized at 6th and 8th digit level. By maintaining same heading code (or first four digits 7102) for both earth mined as well as grown diamonds, similarities on account of their identical properties and difference on account of their point of origin can well be differentiated.

Table 6: Suggested HS Code Classification for Grown vis-à-vis Mined Diamonds

7102	Diamonds, earth mined or grown whether or not worked, but not mounted or set (Suggested)
	Earth-Mined Diamond (Suggested)
7102 10-00	Unsorted
	Earth mined Diamond: Non industrial (Suggested)
7102 31 10	Unworked or simply sawn, cleaved or bruted
7102 39	Other
7102 39 10	Earth-mined diamond, cut or otherwise worked but not mounted or set (Suggested)
7102 39 90	Other
	Grown Diamond (Suggested)
***7102 4000**	Unsorted (Suggested)
	Grown Diamond : Non –Industrial (Suggested)
***7102 41 10**	Unworked or simply sawn, cleaved or bruted (Suggested)
***7102 49**	Other (Suggested)
***7102 49 10**	Grown Diamond, cut or otherwise worked but not mounted or set (Suggested)
7102 49 90	Other (Suggested)

Table 7: Existing HS Code Classification for Natural Pearls and Cultured Pearls

7101	Pearls, natural or cultured, whether or not worked or graded but not strung mounted or set; pearls, natural or cultured, temporarily strung for convenience of transport
7101-10	Natural Pearls
7101 10-10	Unworked
7101 10-20	Worked
	Cultured Pearls
7101 11	Unwrought or in powder form
7101 2100	Unworked
7101 2200	Worked

2. Undertake promotional measures to create awareness -

At this juncture, when diamond growers and grown diamond applications are evolving, it is imperative to create awareness about the grown diamonds at both retail and trade level. For this, the government first, recognizes the long-term growth prospects of grown diamonds; second, re-classify the grown diamonds under the category of diamonds and third, grown diamonds should be promoted through trade shows and exhibitions under the diamonds category. This will enable the people to know about technical aspects of the grown diamonds so as to avoid usage of terms like 'synthetic' or 'artificial diamonds' that are often connected with the product.

We are hopeful that by handholding the grown diamonds as a 'Sunrise Industry' in India through its appropriate classification of HS code and effective promotional measures; all the stakeholders of the diamond industry and the entire society will be able to avail its various benefits and propel the economy's growth, going ahead.

> **It is imperative** *for the government to put a special focus upon grown diamonds by reviewing its HS Code classification and undertaking special promotional measures to position the 'Grown Diamonds' rightly and effectively in the country.*

Conclusions

Diamond industry plays a pivotal role in terms of generating employment and income for an economy. Depletion of this finite resource is inevitable and a major cause of worry for the entire global economy, thus enforcing to look for the best supplementary resource to fulfill the luxury as well as commercial needs of the society. At this juncture, Grown Diamonds, which are the purest form of a diamond and can be grown above earth, are seen as a sustainable and perennial source of high quality diamonds.

The diamond industry occupies a prominent place in Indian economy as the industry generates not only employment opportunities but also foreign exchange earnings for the country. However, presently the diamond industry in India is affected by several adversities viz. devaluation of rupee, global slowdown.

In the light of the rising shortages and prices of mined diamonds, it is crucial for the economy to look for the best supplementarysource of diamonds which can take the diamond industry forward. 'Grown Diamonds' which are identical to mined diamonds are seen as a vital and growing source of diamonds for future. The resource can be put into gem and non-gem applications in addition of carrying various advantages of being sustainable, origin guaranteed, ecofriendly and conflict-free.

However, grown diamonds are not recognized in the country because of lack of knowledge about these diamonds amongst people and furthermore they are classified in the category of synthetic stones. This creates false perception about the grown diamonds as 'artificial' amongst all the stakeholders. Since, grown diamonds are identical to mined diamonds except the point of origin, they should be classified under the category of diamonds (HS 7102) instead of under HS Code (HS 7104) which is for the synthetic stones. Moreover, exclusive promotional measures should be undertaken frequently to create awareness about real benefits and applications of the grown diamonds.

We are hopeful that these are the steps in a right direction to welcome the 'Sunrise Industry' for propelling India's overall economic growth, going forward.

Disclaimer

Project Team

Dr. S P Sharma
Chief Economist & Director of Research

Ms. Rashmi Taneja
Senior Research Officer

Disclaimer
Study on “Grown Diamonds, A Sunrise Industry In India: Prospects For Economic Growth” is prepared by PHD Chamber of Commerce and Industry. This report may not be reproduced, wholly or partly in any material form, or modified, without prior approval from PHD Chamber of Commerce and Industry.

It may please be noted that this report is for guidance and information purposes only. Though due care has been taken to ensure accuracy of the information to the best of the PHD Chamber's knowledge and belief, it is strongly recommended that readers should seek specific professional advice before making any decisions. Please note that the PHD Chamber of Commerce and Industry does not take any responsibility for outcome of decisions taken as a result of relying on the content of this report. PHD Chamber of Commerce and Industry shall in no way, be liable for any direct or indirect damages that may arise due to any act or omission on the part of the reader or user due to any reliance placed or guidance taken from any portion of this publication.

ISBN No. 978 93 84145 22 4

Studies Undertaken by PHD Research Bureau

A. Thematic Research Reports

1. Comparative study on power situation in Northern and Central states of India (September 2011)
2. Economic Analysis of State (October 2011)
3. Growth Prospects of the Indian Economy, Vision 2021 (December 2011)
4. Budget 2012-13: Move Towards Consolidation (March 2012)
5. Emerging Trends in Exchange Rate Volatility (Apr 2012)
6. The Indian Direct Selling Industry Annual Survey 2010-11 (May 2012)
7. Global Economic Challenges: Implications for India (May 2012)
8. India Agronomics: An Agriculture Economy Update (August 2012)
9. Reforms to Push Growth on High Road (September 2012)
10. The Indian Direct Selling Industry Annual Survey 2011-12: Beating Slowdown (March 2013)
11. Budget 2013-14: Moving on reforms (March 2013)
12. India- Africa Promise Diverse Opportunities (November 2013)
13. India- Africa Promise Diverse Opportunities: Suggestions Report (November 2013)
14. Annual survey of Indian Direct Selling Industry-2012-13 (December 2013)
15. Imperatives for Double Digit Growth (December 2013)
16. Women Safety in Delhi: Issues and Challenges to Employment (March 2014)
17. Emerging Contours in the MSME sector of Uttarakhand (April 2014)
18. Roadmap for New Government (May 2014)
19. Youth Economics (May 2014)
20. Economy on the Eve of Union Budget 2014-15 (July 2014)
21. Budget 2014-15:Promise of Progress (July 2014)
22. Agronomics 2014:Impact on economic growth and inflation (August 2014)
23. 100 Days of new Government (September 2014)
24. Make in India: Bolstering Manufacturing Sector (October 2014)
25. The Indian Direct Selling Industry Annual Survey 2013-14 (November 2014)
26. Participated in a survey to audit SEZs in India with CAG Office of India (November 2014)
27. Role of MSMEs in Make in India with reference to Ease of Doing Business in Ghaziabad (Nov 2014)
28. Exploring Prospects for Make in India and Made in India: A Study (January 2015)
29. SEZs in India : Criss-Cross Concerns (February 2015)
30. Socio-Economic Impact of Check Dams in Sikar District of Rajasthan (February 2015)
31. India - USA Economic Relations (February 2015)
32. Economy on the Eve of Union Budget 2015-16 (February 2015)
33. Budget Analysis (2015-16)
34. Druzhba-Dosti: India's Trade Opportunities with Russia (April 2015)
35. Impact of Labour Reforms on Industry in Rajasthan: A survey study (July 2015)
36. Progress of Make in India, September 2015

B. State Profiles

36. Rajasthan: The State Profile (April 2011)
37. Uttarakhand: The State Profile (June 2011)
38. Punjab : The State Profile (November 2011)
39. J&K: The State Profile (December 2011)
40. Uttar Pradesh: The State Profile (December 2011)
41. Bihar: The State Profile (June 2012)
42. Himachal Pradesh: The State Profile (June 2012)
43. Madhya Pradesh: The State Profile (August 2012)
44. Resurgent Bihar (April 2013)
45. Life ahead for Uttarakhand (August 2013)
46. Punjab : The State Profile (February 2014)
47. Haryana: Bolstering Industrialization (May 2015)
48. Progressive Uttar Pradesh: Building Uttar Pradesh of Tomorrow (August 2015)
49. Progressive Uttar Pradesh: Building Uttar Pradesh of Tomorrow, Recommendations Report (September 2015)

PHD Research Bureau

PHD Research Bureau; the research arm of the PHD Chamber of Commerce and Industry was constituted in 2010 with the objective to review the economic situation and policy developments at sub-national, national and international levels and comment on them in order to update the members from time to time, to present suitable memoranda to the government as and when required, to prepare State Profiles and to conduct thematic research studies on various socio-economic and business developments.

The Research Bureau has been instrumental in forecasting various lead economic indicators national and sub-national. Many of its research reports have been widely covered by media and leading newspapers.

Dr. S P Sharma
Chief Economist & Director of Research

Macro Economy, Policy developments & Business Environment

Ms. Megha Kaul
Associate Economist

Global Economy & India's International Relations

Ms. Rashmi Singh
Associate Economist

Foreign Trade & Investments Environment

Ms. Rashmi Taneja
Sr. Research Officer

Mr. P K Mitra
Consultant

Banking, Taxation & Financial Markets

Ms. Surbhi Sharma
Sr. Research Officer

State Affairs, Agriculture & Rural Development

Ms. Huma Saif Qazi
Research Associate

Infrastructure- Physical and Social

Ms. Apurva Munjal
Research Associate

Ms. Sunita Gosain
Secretarial Assistant

PHD CHAMBER

PROGRESS HARMONY DEVELOPMENT

Estd. - 1905

About the PHD Chamber

PHD Chamber of Commerce & Industry, a leading Industry Chamber of India, ever since its inception in 1905, has been an active participant in the India Growth Story through its Advocacy Role for the Policy Makers and Regulators of the Country. Regular interactions, Seminars, Conference and Conclaves allow healthy and constructive discussions between the Government, Industry and International Agencies bringing out the Vitals for Growth. As a true representative of the Industry with a large membership base of 48000 direct and indirect members, PHD Chamber has forged ahead leveraging its legacy with the Industry knowledge across sectors (58 Industry verticals being covered through Expert Committees), a deep understanding of the Economy at large and the populace at the micro level.

At a Global level we have been working with the Embassies and High Commissions in India to bring in the International Best Practices and Business Opportunities.

Seven Thrust Areas

- Industrial Development
- Infrastructure
- Housing
- Health
- Education and Skill Development
- Agriculture and Agribusiness
- Digital India

CSR IMR

India-My Responsibility

PHD CHAMBER OF COMMERCE AND INDUSTRY

PHD House, 4/2 Siri Institutional Area, August Kranti Marg, New Delhi - 110 016 (India)
Tel. : +91-112686 3801-04, 49545454, 49545400 · Fax : +91-11-2685 5450
E-mail : phdcci@phdcci.in · Website : www.phdcci.in