Design Making & Rapid Prototype Jewellery at Surat

Gems & Jewellery
Government of Gujarat
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Project Concept

What is design making?

Design making is the initial stage of jewellery making. Jewellery designers often create several different types of jewellery, however, some specialize in designing only a particular type of jewellery. For instance, a designer may only create necklaces or rings and some may only design jewellery for certain events or individuals, such as weddings or royalty.

During the design stage, jewellery designers typically put their ideas on paper. Traditionally, this was done using paper and writing instruments. However, today’s evolving technology makes it possible to create jewellery designs using computer software with ease.

Jewellery design process

What is rapid prototyping?

Rapid Prototyping is a combination of techniques used to quickly fabricate a scale model of a part or assembly using three-dimensional computer aided design (CAD) data. In jewellery it is used for the transformation of created 3D CAD models into physical objects which helps to develop and show visually any shape of jewellery models.

Rapid prototyping process

1. Create a CAD model of the design
2. Convert the CAD model to STereoLithography (STL) format
3. Slice the STL format to thin cross sectional layers
4. Construct the model one layer atop another
5. Detach supports; clean and finish the model

Source:
http://www.efunda.com/processes/rapid_prototyping/intro.cfm
Project Concept

Handmade and gems-set jewellery manufacturing process

Merchandising ➔ Gold melting and refining ➔ Filing and linking ➔ Selling/ exporting
Designing ➔ Assaying and purity checking ➔ Cleaning and polishing ➔ Hallmarking
Order taking ➔ Component making ➔ Plating/ finishing ➔ Tagging and dispatching
Procurement ➔ Frame making ➔ Stone setting ➔ Final quality checking

Data flow in rapid prototyping

3D CAD ➔ 2D CAD Drawing/ Manual outline/ Lattice Data ➔ Point cloud data ➔ Data acquired from MRI or CT Scan

Point cloud data ➔ Reverse engineering ➔ 3D reconstruction/ 2.5D reconstruction

3D CAD ➔ STL (3D) Layer information, SCL or CLI

Specification of machine layer information ➔ Machine data set

Geometric data

Auxiliary geometry (supports etc.)

Source:
## Classification of rapid prototyping

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<tbody>
<tr>
<td><strong>1</strong></td>
<td><strong>Stereo Lithography</strong></td>
<td>A laser generates an ultraviolet beam which solidifies the surface areas of a photopolymer as per the instructions in .STL file. This process continues, slice by slice, until the system completes the part.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td><strong>Selective Laser Sintering</strong></td>
<td>The process begins with the deposition of a thin layer of powder, which is heated to just below its melting point. A laser selectively traces the surface of the powder and sinters the material together. This process continues layer by layer until a final product is complete</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td><strong>Laminated Object Manufacturing</strong></td>
<td>Layers of sheet materials such as paper, plastics, or composites are attached to a stack, and the laser cuts away the unused portions. This process is considerably fast as the laser is cutting around the periphery of the object, building a thick-walled part rather than thin-walled one</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td><strong>Solid Ground Curing</strong></td>
<td>The input of the 3D CAD data of is used to generate the cross-sectional slice data of the model and for selection of layer thickness. The production machine then uses these data to cure an entire layer of photopolymer in a solid environment. An ultraviolet light completely cures the material through a photo mask and no post curing is required.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td><strong>Fused Deposition Modeling</strong></td>
<td>A software processes an STL file, mathematically for slicing and orienting the model. Also the support structures can be generated if required. The machine may dispense multiple materials to achieve different goals: For example, one material may build up the model and another may be used as a soluble support structure.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td><strong>Three Dimension Printing</strong></td>
<td>The machine reads the design from a .STL file and lays down successive layers of liquid, powder, paper or sheet material to build the model from a series of cross sections. These layers, which correspond to the virtual cross sections from the CAD model, are joined or automatically fused to create the final shape.</td>
</tr>
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</table>

Market Potential

India is the third largest country globally in terms of revenue sales for the gems and jewellery market in 2014

► In 2014, India’s share of revenues in the global gems and jewellery industry was 20.8%.
► During the same year, India was the second largest country in APAC region in the gems and jewellery market, with ~40% revenue share.
► The major product segment in the Indian gems and jewellery market is gold jewellery, contributing 46.8% of overall revenues in 2014.

Jewellery market in India

The jewellery market is expected to grow at a CAGR of 16.1% between 2014 and 2019.
Rising per capita income, availability of skilled labour and benefits from SEZs are some of the drivers of the jewellery industry in India.

There is a rising demand for design making and rapid prototyping to meet the growing jewellery industry in India

► The Indian jewellery manufactures and retailers contributed ~7% towards the GDP of the country in 2015, creating a value addition of INR1000 billion. They also contribute ~14% towards exports, second only to textile and apparel sector.
► The cumulative FDI inflows in diamond and gold ornaments between April 2000 and December 2015 were US$751.4m, according to Department of Industrial Policy and Promotion.

Market potential for Gujarat

► Gujarat has the highest share (~85%) in the total national jewellery production and accounts for 72% of the world’s share of processed diamonds.
► 90% of the total diamonds in Gujarat are processed by about 10,000 diamond units located in and around Surat.

Source:
## Growth Drivers

<table>
<thead>
<tr>
<th>Cost and time efficiency</th>
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<tr>
<td>▶ Rapid prototyping is a quicker, more cost effective means of building prototypes as opposed to conventional methods.</td>
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<tr>
<td>▶ Manufacturing time for parts of virtually any complexity is measured in hours instead of days, weeks, or months. Firms using rapid prototyping have gained time reductions in the production of prototype tooling and parts, which is mostly how these time savings have been specified.</td>
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<table>
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<tr>
<th>Quality enhancement</th>
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<tbody>
<tr>
<td>▶ In rapid prototyping, designs can be customized according to individual requirement without any additional cost or special tools.</td>
</tr>
<tr>
<td>▶ The risk of faults and usability issues can be identified during the procedure of rapid prototyping. Thus, manufacturers can produce quality jewellery with minimal design flaws.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Waste reduction</th>
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<tr>
<td>▶ Unlike subtractive manufacturing, rapid prototyping does not leave unused cut-off stock or chippings.</td>
</tr>
<tr>
<td>▶ Here model material is applied only where it is needed, although some processes require the use of a sacrificial supporting structure especially in the case of overhanging geometry.</td>
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<thead>
<tr>
<th>Design influencing customer decision making</th>
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<tbody>
<tr>
<td>▶ Customers have started to become brand conscious and give importance to the design of the jewellery while making a buying decision.</td>
</tr>
<tr>
<td>▶ The design of the piece is given importance by 64% women while selecting a diamond jewellery. Companies are thus emphasizing on not just the quality of the jewellery but also its design.</td>
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<table>
<thead>
<tr>
<th>Technology oriented</th>
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<tr>
<td>▶ More than one fifth of Chinese women and around one third of American women search for designs online before actually making a purchase.</td>
</tr>
<tr>
<td>▶ In India, 12% of women purchasers use the internet to pre-select designs or learn more about diamond jewellery. As a result, jewellers are required to keep coming up with latest designs to enhance growth in the competitive environment.</td>
</tr>
</tbody>
</table>

Source:


[http://www.mdtmag.com/article/2015/03/5-key-benefits-using-rapid-prototyping-product-design-development](http://www.mdtmag.com/article/2015/03/5-key-benefits-using-rapid-prototyping-product-design-development)

Gujarat - Competitive Advantage

Gems and jewellery clusters in Gujarat

- To leverage on the progressive industrial sector of the state, the government initiated a “Cluster development” model to increase efficiency and cost competitiveness through collaborative efforts and knowledge sharing.
- Surat is the largest diamond processing cluster in the world and is called ‘A Silky City Sparkling with Diamonds’.

Gujarat fares highly when it comes to setting up a business, allotment of land and obtaining a construction permit.

- Surat is an important diamond processing centre, exporting ~80% of the production. The city has more than 3,500 diamond processing units.
- The easy availability of processed diamonds makes it a natural choice for manufacturers of diamond studded jewellery.

Established infrastructure

- Located on the west coast of India, Gujarat is well connected to the major cities of the world by air and sea routes.
- The state has 45 ports, 12 domestic airports and 1 international airport in addition to an extensive rail and road network.
- Gujarat is the one of the power surplus states in the country as a result it helping in bringing huge amount of investment from the industries and tagged as preferred investment destination in the country.

Economic development

- The government is continuously improving infrastructure in Gujarat, encouraging manufacturers to invest in the state.
- Gujarat contributes 7.2% of the Nation GDP and shows leadership in many areas of manufacturing and infrastructure sectors.
- The government has set up various SEZs to provide special incentives to the highly export-oriented sector. The SEZs have units catering to designing, cutting and polishing of jewellery.

Source:
Jewellery manufacturing at Surat

- Surat is the diamond manufacturing and processing hub of India and is slowly developing its jewellery manufacturing units.
- The government supported the setting up of a Special Economic Zone in Surat with more than 175 fully functional companies catering to industries such as diamonds, jewellery, textiles and chemicals.
- The city’s proximity to Hazira port and mature transport system makes it an attractive hub for investors and manufacturers.

High dependence on import of raw materials

- Gems and Jewellery industry is highly dependent on imports of raw materials, of which rough diamonds account for almost 50% of the imports.
- The industry is also highly dependent on import of gold due to its limited production in the country which has made them extremely vulnerable to any regulations that constrain gold supply.

Gujarat is the hub of skilled artisans for jewellery manufacturing

Location of major educational institutions

- There are ~60,000 jewellery manufacturing units in India, with heavy dependence on skilled workers and artisans.
- ~95% of the jewellery artisans hail from Bengal with more than 0.7 million of them working in South Gujarat alone.
- There are ~700 jewellery manufacturing units, mostly located in the walled city areas, that employ over 0.25 million artisans.
- There are a number of institutions offering specialized courses in the gems and jewellery sector across Gujarat.

Source:
http://www.sursez.com/about-us.html
Project Information

Logistics & Connectivity

Rail

- Surat is connected with other districts of the state such as Rajkot, Vadodara and Ahmedabad by rail.
- Hazira port in Surat is ~16 kms away from the Surat railway station.

Proposed

- The Mumbai-Ahmedabad bullet train project will have Surat as one of the stations.
- In 2016, the Gujarat government assigned Delhi Metro Rail Corporation as a consultant for the proposed metro connectivity in Surat.
- Rail connectivity was proposed for Hazira and Nargol ports in the 2016 rail budget.

Road

- The city is connected to Delhi Mumbai Industrial Corridor (DMIC) which links Ahmedabad, Vadodara and Surat.
- Proximity to NH-8 and NH-6 further enhances connectivity in the city.
- Surat also has very good connectivity with other cities of the state such as Vadodara (154 km) and Ahmedabad (265 km).

Proposed

- Proposed four-lane highways which are expected to improve connectivity in Surat include – Dakor-Savli, Vadodara-Dabhoi & Surat-Olpad-Bardoli.

Air

- Surat domestic airport is well connected to various parts of the country. The city is located ~275 kms from the international airport at Ahmedabad.

Proposed

- In January 2015, Airports Authority of India gave an in-principle approval for cargo terminal at Surat airport worth INR70 million. The terminal is expected to be operational in 2017.
- In February 2016, Surat Airport Action Committee filed an online petition for an international airport at Surat.

Port

- The nearest port is Hazira which is 25 km from Surat.
- Additionally, Hazira port is well connected to Mundra port and Jawaharlal Nehru Port Trust (JNPT) – India’s largest container port
- Thus, it provides a convenient textiles-related trade gateway to International (Europe, Africa, America and the Middle East) and domestic markets.

Utility

Water

- Water for industrial purposes can be obtained from four sources viz. Gujarat Water Supply and Sewerage Board (GWSSB), an irrigation canal, dams, and surface reservoirs.

Power

- The main source for the power supply is Torrent Power Limited in Surat

Source:
http://deshgujarat.com/2015/03/25/clearances-by-july-works-for-nargol-port-to-start-next-yeargog/
# Project Information

## Key Players in India

<table>
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<tr>
<th>Company</th>
<th>Services</th>
<th>Headquarter Location</th>
</tr>
</thead>
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<tr>
<td>Imaginarium</td>
<td>Rapid prototyping, Rapid manufacturing</td>
<td>Mumbai, Maharashtra</td>
</tr>
<tr>
<td>Clarity 3D printing</td>
<td>3D printing</td>
<td>Mumbai, Maharashtra</td>
</tr>
<tr>
<td>3D Jewels</td>
<td>Jewellery designing, CAD/CAM solution provider</td>
<td>Bangalore, Karnataka</td>
</tr>
<tr>
<td>Jewel Kreator</td>
<td>Rapid prototyping, 3D printing</td>
<td>Rajkot, Gujarat</td>
</tr>
<tr>
<td>Kushal Technologies</td>
<td>Rapid prototype machinery supplier</td>
<td>Pune, Maharashtra</td>
</tr>
<tr>
<td>Kaizer 3D printer</td>
<td>Create 3D prototypes</td>
<td>Mumbai, Maharashtra</td>
</tr>
<tr>
<td>W.J.T Trading Co.</td>
<td>3D printing machine, Rapid prototype 3D printer machine</td>
<td>Mumbai, Maharashtra</td>
</tr>
<tr>
<td>Shree Rapid Technologies</td>
<td>Rapid prototyping and rapid manufacturing systems provider</td>
<td>Mumbai, Maharashtra</td>
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## Potential collaborations

Following are a few potential collaboration opportunities:

<table>
<thead>
<tr>
<th>Company/Institution</th>
<th>Description</th>
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<tbody>
<tr>
<td>Gitanjali group</td>
<td>The company plans to have CAD &amp; Rapid Prototyping facilities for product development in its Hyderabad gems SEZ. It can look out for potential collaboration opportunities with companies providing such services to strengthen its services in this segment.</td>
</tr>
<tr>
<td>Indian Diamond Institute</td>
<td>IDI offers various courses in rapid prototyping and jewellery designing. Companies can collaborate with the institute to hire students graduating from such courses.</td>
</tr>
</tbody>
</table>

Source:
http://www.imaginarium.co.in/verticals-jewelery.php
http://www.clarity3dprinting.com/rapid-prototyping.html
http://kaizer3d.com/contact.html
http://3djewelsindia.com/
http://www.jewellkreator.com/
http://www.tradeindia.com/manufacturers/rapid-prototype-machine.html
http://www.jewellerytoolsstore.com/3d-printer.html
http://www.shreerapid.com/
http://www.gitanjaliworldgroup.com/business/businesses_infra_sezs.html
http://www.diamondinstitute.net/jewellery-diploma.html
The jewellery manufacturing and the gemstones polishing industries are heavily dependent on skills of their workers for producing customised designs rather than using machines that cater to the mass market requirements.

A consequent challenge is that of upgrading the skills of traditional artisans in a way that they adopt new technology and acquire certifications, while retaining their traditional expertise and artistic appeal.

Jewellery manufacturers in India tried to stock up gold after change in gold norms. As a result, they fell short of money for diamonds which ultimately affected their manufacturing capabilities.

In October 2015, Bharat Diamond Bourse banned trading of synthetic diamonds on its premises, which was as a major roadblock to diamond jewellery manufacturers who have been using synthetic diamonds.

The size of imitation jewellery in India is ~INR120 billion, growing at a rate of 25% to 30% annually. The country also faces strong competition from China and Korea who have already captured 30% of the Indian imitation jewellery market.

India faces stiff competition from China, the second largest diamond processing centre in the world after India. Easy adoption of technology has helped China to produce diamonds at a competitive price.

Source:
Project Financials

Project components

► Laser welding Service & Repair facilities
► CAD/CAM software that allows 3D designs
► Precious metal castings
► Non shrink RTV silicone moulding
► Vacuum Wax Injecting for accuracy
► Magnetic tumbling facilities
► Polishing equipment
► Diamond setting
► Rhodium and gold plating device

Land cost

► The average allotment price of Gujarat Industrial Development Corporation estates in Surat is INR2,319 per square meter with effect from 1 April 2016.
► In Surat district, Katodara is the most expensive area, priced at INR 5,130 per square meter and Doswada is the least expensive at INR80 per square meter.

Labour cost

► The labour cost per carat in Gujarat is ~INR600, the lowest among the major diamond trading centers across the world.

Machinery Cost

<table>
<thead>
<tr>
<th>Printer</th>
<th>Average cost</th>
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<tr>
<td>3 D Printers</td>
<td>INR 2 to 5 lacs</td>
</tr>
<tr>
<td>Diamond Rapid Prototyping System</td>
<td>INR 150 lac to INR 200 lac</td>
</tr>
<tr>
<td>Polishing Machine</td>
<td>INR 0.1 lac to INR 0.7 lac</td>
</tr>
<tr>
<td>Moulding &amp; Casting equipment</td>
<td>INR 0.1 lac to INR 0.25 lac</td>
</tr>
</tbody>
</table>

Sub Total                             | INR 152.2 lac to INR 207.95 lac |

Space cost @ INR 5130 per sq m for 250 to 300 sqm space | INR 12.83 lac to INR 15.39 lac |

Total Cost                             | INR 165.03 lac to INR 223.34 lac |

Source:
http://www.gidc.gov.in/pdf/tenders/PDF/16-17/Allotment-Price-2016-17.pdf
Approvals & Incentives

**Incentives from Government of Gujarat for Jewellery Manufacturers – Government Resolution No. GEM/2008/1685/CH**

- Exemption from obtaining No Objection Certificate from the Gujarat Pollution Control Board for establishing a gems and jewellery industry and for conversion of land to 'non agricultural' use.
- Maximum interest subsidy at the rate of 3% per annum, limited to maximum of INR1.5 million per annum available to modern jewellery units for a maximum of 5 years.
- Assistance of viability gap funding of 20% of the total project cost to private developer intending to develop Jewellery park on PPP basis.
- Support and assistance for establishing skill development centres, Hallmark Certification centres and diamond testing centres.

**Assistance for Interest Subsidy to Service Enterprise 2015**

**Government Resolution No. SSI – 102014-924840-CH**

- Under this scheme, new MSME Service Sector having investment machinery and equipment worth more than INR 5 lakhs will be eligible for Interest Subsidy @ 5% of term loan for machinery & equipment with maximum limit of INR 25 lakhs per annum, for a period of 5 years.
- A 1% additional interest subsidy will be offered if the enterprise is set up with required equity contribution for the project @100% by youth/s having age less than 35 years of age as on date of sanction of term loan.

**Recently approved incentives by Government of India**

- Exemption from submission of any ground plan of the premises for taking excise registration.
- Excise duty on jewellery to be payable at first sale invoice value. Sale of traded goods to be exempted from excise duty.
- Exemption from excise audit for the first two years for units whose duty payment (cash plus credit) is less than INR10 million, with turnover of manufactured goods less than INR1000 million.
- Increase in Supplemental Security Income (SSI) eligibility limit from INR120 million to INR150 million.
- Increase in Supplemental Security Income (SSI) exemption limit from INR60 million to INR100 million in a financial year and INR8.5 million for the month of March, 2016.

Source:
http://gpcb.gov.in/industries-exempted.htm
http://ic.gujarat.gov.in/?page_id=329
http://www.finmin.nic.in
Gujarat government Introduced Scheme of Assistance to MSEs for Shed and Plot Developed by Private Developer (Government Resolution MIS/102014/430906)

**Assistance to Private Developer for Developing Readymade sheds in Mini Estate**

- Government of Gujarat, in order to facilitate small estates having a small row type shed for MSEs has introduced this scheme
- Under the scheme, assistance is provided to private developers @ 50% of the total cost of land, building and other infrastructure facilities who meet the following conditions:
  - Size of the shed shall be around 50 sq. m. (500 sq. ft), size of the mini estate shall not be more than 2 ha.
  - Land shall be in industrial zone or commercial zone in the Municipal Corporation/Urban Development Authority. All the proposed infrastructure must be completed within 2 years from date of sanction

**Assistance in Rent to MSEs**

- This scheme was introduced by the Government of Gujarat to help MSE industrial units to keep more margins for purchase of land and buildings while approving loans from financial institutions
- Under the scheme assistance of upto 50% of rent paid or INR 50,000/- per annum, whichever is less in Municipal corporation area and under the Urban Development Authority
- Assistance of upto 50% of rent paid or 25,000/- per annum, whichever is less in other areas is provided for 3 years

Source
http://gpcb.gov.in/industries-exempted.htm
http://ic.gujarat.gov.in/?page_id=329
This project profile is based on preliminary study to facilitate prospective entrepreneurs to assess a prima facie scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.