Several techniques and models may be adopted to address issues related to productivity and competitiveness. One such popular set of tools is known as “Lean Manufacturing Techniques”. The aim of the article is also to provide an introduction to the “Lean Manufacturing Competitiveness Scheme” promoted by the Government of India that can be made use of by the organisations in the jewellery manufacturing industry.

The techniques can be used to improve productivity and competitiveness. In a globalised world, increasing competition is a fact of life and the Indian jewellery industry is no exception. In such a scenario, the only way forward for the industry is to become globally competitive by adopting global best practices in productivity.

**What is Lean?**

Lean Manufacturing or Lean Production, which is often known only as Lean, is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination.

Lean manufacturing was developed by the Japanese automotive industry, principally Toyota, following the challenge to re-build the Japanese economy after World War II. Until the 1990s, it was only the automotive industry that had adopted Lean Manufacturing. Since then, it has spread to general manufacturing, consumer electronics, healthcare, construction, food processing, logistics and distribution, services, retail, maintenance and even government.

Lean means without waste. Lean is a practice which considers any activity or effort not contributing to value creation as waste. In other words it is a simple way to produce what the customer wants, at a time when they want it and at a price they are prepared to pay, using least resources.

Eliminating waste creates processes that need less human effort, less space, less capital, and less time to make products and services at far less costs and with much fewer defects, compared with traditional business systems. Companies are able to respond to changing customer desires with high variety, high quality, low cost, and with very fast throughput times. Lean is a set of “tools” that assists in the identification and steady elimination of waste. As waste is eliminated, quality improves while production time and cost are reduced. Besides the aim of waste reduction, Lean also focuses on improving the “flow” or smoothness of work.
Application of Lean Manufacturing Techniques in Jewellery Industry

The jewellery industry can also adopt and benefit from Lean Techniques as it aims to eliminate waste and improve flow of work. We have to understand “waste” in the context of the jewellery manufacturing process.

What is waste - Waste can arise at the following stages:

1. During design stage – Work that can be proactively avoided can be decided at this stage so that wasteful practices are not built into work practices.
2. During planning stage – Planning and scheduling can be done in a manner that prevents loss of time, less inventories and so on.
3. During operations stage – This is reactive as compared to the earlier actions and is to be addressed after the process is in place. Lean considers the following wastes as relevant to the operational stage:
   - Transportation – Moving products that are not actually required to perform the processing
   - Inventory – All components, work in process and finished products not under process
   - Motion – People or equipment moving or walking more than is required to perform the processing
   - Waiting – for the next production step
   - Overproduction – production ahead of demand
   - Over processing – due to poor tool or product design
   - Defects – effort involved in inspecting and fixing defects – cost of quality

Lean Techniques:

Lean techniques essentially propagate the following:

1. Design a simple manufacturing system
2. Recognise that there is always room for improvement
3. Continually improve the manufacturing system design / processes

The widely used lean manufacturing techniques are:

1. 5S system: It propagates the basic set of requirements to keep a workplace efficient. 5S stand for Sort, Set in Order, Shine, Standardise and Sustain and these can be explained as under:
   - Sort – Eliminate the clutter – “When in doubt, throw it out”
   - Set in Order – Organise and label, set boundaries and limits – “A place for everything and everything in its place”
   - Shine – Clean everything inside and out – “Inspection through cleaning”
   - Standardise – Keep checklists, charts etc. and make them visual – “Everything in a state of readiness and service”
   - Sustain – Maintain discipline through the implementation of continual improvements

The 5S concepts consistently produce an organised workplace resulting in increase in quality and productivity and a reduction in required work place.

Ultimately, housekeeping and workplace organisation are directly linked to achieving discipline in manufacturing. Lean manufacturing cannot be achieved without the culture and discipline of 5S in place.

2. Visual Control: Visual systems are a form of communication and can be used to direct flow and identify problems / needs / status with minimal interaction from a person. Typically, these can be no or low cost solutions and can be quickly implemented to improve people, information and document flows. Visual communication uses specific methods and techniques to provide fast, two-way communication between teams, shifts, co-workers and management and can be used anywhere in the organisation. Simple signals that provide an immediate understanding of a situation or condition such as charts, light signals, lane marking on floor, safety instructions, warning signs etc. are examples of visual control. They are generally efficient, self regulating and worker managed.

3. Standard Operating Procedures (SOPs): An SOP is a written document / instruction detailing all steps and activities of a process or procedure. These should be carried out without any deviation or modification to guarantee the expected outcome. All quality impacting processes and procedures should be laid out in SOPs. These SOPs should be the basis for training new employees and checking work of experienced employees. SOPs must be regularly reviewed and updated to assure compliance to the regulatory requirements and work practices.

4. Just in Time (JIT): JIT aims at producing the right product in right quantity at the right time. This almost results in zero inventory and shortest possible cycle time. The application of JIT leads to the following benefits:
   - Reduction in inventory by more than 50%
   - Reduction in lead time by more than 50%
   - Reduction in rework
   - Reduction in space by over 40%
Considering the above, examples of waste in jewellery manufacturing can be listed as below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Waste</th>
<th>Effect of waste</th>
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<tbody>
<tr>
<td>1</td>
<td>Rework - Most jewellery pieces are subjected to rework and the rework percentage is generally very high depending upon the manufacturing technique used and the design complexity</td>
<td>■ Limits competitiveness in establishing selling price because these costs are ultimately borne by the buyer. Prevents on-time deliveries which cause additional costs in terms of overtime, premium freight and other administrative costs. Represents quality problems which may reach customers even if 100% inspection methods are in place. It is a statistical fact that 100% inspection is only 85% effective.</td>
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<tr>
<td>2</td>
<td>TR (Total Rejection): Pieces which have become non-conforming to customer requirements and having to undergo a non value added melting process for recovery of precious metal is a waste.</td>
<td>Costs of rejection have to be absorbed by good pieces and in turn by the customer. TR contributes to approximately 3% - 5% of total production waste.</td>
</tr>
<tr>
<td>3</td>
<td>Extra Pieces – Produced to compensate for TR</td>
<td>These represent additional waste to compensate original waste.</td>
</tr>
<tr>
<td>4</td>
<td>Process Bottlenecks – Work in process builds up due to imbalance in capacities</td>
<td>■ Idle manpower</td>
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<tr>
<td>5</td>
<td>Machine Downtime – May happen due to inadequate maintenance systems</td>
<td>■ Reduces manufacturing capacity. When critical equipment breakdown, the consequences could be serious.</td>
</tr>
<tr>
<td>6</td>
<td>Inventories</td>
<td>■ Inventories held up in all stages from gold central to finished goods storage is considered a waste. ■ Carrying costs of inventories could add upto 25% - 30% per year.</td>
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</table>
5. **Value Stream Mapping**: This lean technique is used to analyse the flow of materials and information currently required to bring a product or service to a customer. Value stream mapping is commonly used to identify opportunities for improvement in lead time. Value stream mapping is also used in logistics, supply chain, service industries, product development etc.

6. **Poke Yoke or Mistake proofing**: This technique is used to prevent errors at their source of origin leading to zero-defect product. The idea behind this technique is to free a person’s mind from maintaining repetitive vigil on the processes. It is a cost effective tool using very simple devices to prevent the production of defective products.

7. **Total Productive Maintenance (TPM)**: TPM focusses on the objective of zero breakdowns. Emphasis is given on first line preventive maintenance by the operators, which is then supported by initiatives by specialists. TPM implementation leads to improved productivity and quality of products.

8. **Kaizen**: Kaizen or continuous improvement is about doing “little things” better everyday. It is slow, gradual but continuous improvement. Problem solving under Kaizen is a cross functional, systematic and collaborative approach.

9. **Six Sigma**: Six sigma is a technique to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimising variability in manufacturing and business processes.

**Benefits of Lean Manufacturing** can be summarised as below:

a) Reduction in waste
b) Improvement in productivity and quality
c) Introduction of innovative practices for improving competitiveness
d) Induce good management practices
e) Increase in output
f) Reduction in customer complaints
g) Better adherence to delivery schedules
h) Reduction in stage wise rejections
i) Lesser inventory requirements
j) Optimum utilisation of resources like space, manpower, materials, equipment, energy, consumables etc.
k) Orderly work place and
l) Culture of continuous improvement

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**Lean Manufacturing Competitiveness Scheme (LMCS):**

The Ministry of Micro, Small and Medium Enterprises (MSME), Government of India has formulated a “National Manufacturing Competitiveness Programme” with an objective to support the industry in their endeavour to become competitive.

One of the components of the National Manufacturing Competitiveness Programme is the “Lean Manufacturing Competitiveness Scheme (LMCS).

The ministry will subsidise the costs of the scheme to the extent of 80% and the participating organisations will have to bear only 20% of the cost. Units having investment of below Rs.10 crore in plant and machinery are eligible to participate in the scheme. The scheme will be simultaneously for a group of 8 to 10 companies called a “Cluster”.

The ministry has established a system for monitoring the scheme that will be implemented through accredited consultants. RSM Astute is one of the accredited consultants for the scheme.